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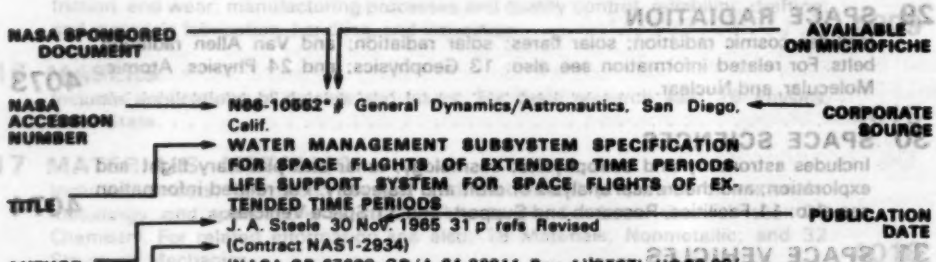
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N66-10662* # General Dynamics/Astronautics, San Diego, Calif.
CORPORATE SOURCE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
TITLE
PUBLICATION DATE
J. A. Steele 30 Nov. 1965 31 p refs Revised
AUTHOR
(Contract NAS1-2934)
(NASA-CR-67600; GD/A-64-26211, Rev. A)
CFSTI: HC $2.00/MF $0.50
CSCL 06K
SALES AGENCY AND PRICE
CONTRACT OR GRANT
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed.
REPORT NUMBER
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VOLUME 4 NUMBER 20

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

October 23, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-34102*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LOW-SPEED ROLL EFFECTIVENESS OF A DIFFERENTIALLY DEFLECTED HORIZONTAL-TAIL SURFACE ON A 42° SWEPT-WING MODEL

Peter C. Boisseau Washington, NACA, 19 Jun. 1956 30 p refs

(NACA-RM-L56E03) CFSTI: HC $2.00/MF $0.50 CSCL 01A (Declassified)

An investigation has been made in a free flight tunnel to determine the roll effectiveness of a differentially deflected horizontal tail on a 42° swept-wing model. The model was tested through an angle-of-attack range of 0° through the stall in the clean and landing configurations with the horizontal tail in a low position. The model was also tested in the clean configuration with the horizontal tail in the middle or high positions. Evaluated on the basis of longitudinal trim conditions, differential deflection of the horizontal tail produced large favorable yawing moments when the tail was in the low position and large adverse yawing moments when the tail was in a high position but produced only small yawing moments for the middle-tail position. Author

N66-34192# North American Aviation, Inc., Los Angeles, Calif.

LINEAR, ROTATIONAL FLOW OVER THE WINDWARD SIDE OF A HYPERSONIC DELTA WING

Norman D. Malmuth [1966] 38 p refs

(Contract AF 49(638)-1477)

(NA-66-495; AFOSR-66-0650; AD-634146) CFSTI: HC $2.00/MF $0.50

The hypersonic flow over the compression side of a delta wing is analyzed within the framework of Van Dyke's small disturbance theory and the assumption that the vertex angle of the Mach cone bounding the central nonuniform intersection region is small in comparison to the wing apex angle. Asymptotic expansions of the flow quantities in terms of a small parameter equal to the ratio of the tangents of these angles are introduced. The leading terms in these expansions correspond to the flow over a wedge of semivertex angle equal to the incidence of the delta wing, and the second order terms are linear rotational perturbations due to the three-dimensional interaction across the wing. By use of methods previously developed for other wedge-like hypersonic conefields, the lift, shock shape and pressure field over the wing are obtained. Perturbation and total quantities are compared with results from the numerical solution of Babaev giving good qualitative agreement for the former and satisfactory quantitative accord for the latter, within the assumptions of the theory. Author (TAB)

N66-34247# Southampton Univ. (England).

HELICOPTER BLADE SLAP

F. Webb Taylor and John W. Leverton Jun. 1966 15 p refs Presented at the Army Sci. Conf., U. S. Military Acad., West Point, N. Y., 14–17 Jun. 1966

(AD-634644) CFSTI: HC $1.00/MF $0.50

The paper considers a possible mechanism for the generation of blade slap. A simplified theory for this is presented which shows good agreement with the results obtained from a test rig on which blade slap was simulated. In particular it shows that the noise is dependent on the fourth power of the velocity and the square of the gust size (vortex strength). The results are sufficiently encouraging to warrant the extension of the analysis to that of an actual helicopter. Normally, blade element velocity in a helicopter cannot be varied appreciably; it is fixed by far more important aerodynamic considerations. The profile of a vortex and its path are very important considerations that may possibly be partially controllable. Because the noise increases with the square of the vortex velocity amplitude (W), highly loaded rotor blades, which produce a strong tip vortex have a greater penchant toward loud blade slap. This contributes to the severity of the blade slap on the Iroquois which has a highly loaded two-bladed rotor. Author (TAB)

N66-34833*# Rice Univ., Houston, Tex.

THREE-DIMENSIONAL, LIFTING WINGS OF MINIMUM DRAG IN HYPERSONIC FLOW

Angelo Miele and David G. Hull 1966 29 p refs

(Grant NGR-44-006-045)

(NASA-CR-77291; AAR-26) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The problem of minimizing the drag of a three-dimensional, slender, flat-top wing of given span in hypersonic flow is considered under the assumptions that the pressure coefficient is modified Newtonian and the skin-friction coefficient

is constant. The indirect methods of the calculus of variations in two independent variables are employed, and the minimum drag problem is solved for given lift and given lift and volume. If the lift is the only given quantity, the optimum wing has a constant chordwise slope and a trailing edge thickness distribution similar to the chord distribution. While the planform area is uniquely determined, the chord distribution is not. In other words, there exist an infinite number of chord distributions yielding the same maximum value of the lift-to-drag ratio. If the lift and the volume are given, two solutions are possible depending on the value of the volume-lift parameter, a parameter directly proportional to the volume and inversely proportional to the lift squared. Also, the chordwise slope is constant in the spanwise sense but not in the chordwise sense. Finally, the maximum lift-to-drag ratio decreases as the volume-lift parameter decreases. Author

N66-34877*# Rice Univ., Houston, Tex.
LIFTING BODIES OF MINIMUM DRAG IN HYPERSONIC FLOW
Arthur H. Lusty, Jr. 1966 42 p refs
(Grant NGR-44-006-034)
(NASA-CR-77177; AAR-21) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The problem of minimizing the drag of a slender, flat-top, homothetic body in hypersonic flow is considered under the assumptions that the pressure coefficient is Newtonian and the skin-friction coefficient is constant. The indirect methods of the calculus of variations are employed, and the necessary conditions to be satisfied by an optimum body are derived for arbitrary conditions imposed on the lift, the wetted area, the volume, the length, and the thickness. The particular cases treated are: (1) given lift, (2) given lift and thickness, (3) given lift and wetted area, (4) given lift and length, and (5) given lift and volume. For the first three cases, simple analytical solutions are found; for the last two, parametric solutions of a more complex nature are determined. Author

N66-34797*# Rice Univ., Houston, Tex.
THREE-DIMENSIONAL WINGS OF MAXIMUM LIFT-TO-DRAG RATIO IN HYPERSONIC FLOW Aero-Astronautics Report No. 27
Angelo Miele and David G. Hull 1966 25 p refs
(Grant NGR-44-006-045)
(NASA-CR-77176) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Consideration is given to optimizing the lift-to-drag ratio of a slender, three-dimensional, flat-top wing of given planform in hypersonic flow. It is assumed that the pressure coefficient is modified Newtonian and the skin-friction coefficient is constant. Base drag is neglected, and the contribution of the tangential forces to the lift is considered to be negligible with respect to the contribution of normal forces. Indirect methods of variational calculus in two independent variables are employed, and maximum lift-to-drag ratios are determined for both a free and a given volume. It is shown that for a free volume, optimum wing surface has a constant chordwise slope and a trailing edge thickness distribution similar to the chord distribution. For a given volume, the chordwise slope is constant in the spanwise but not chordwise sense. In the case of a given volume, optimum wing is convex if the volume parameter exceeds a certain critical value and slightly concave if the volume parameter is less than the critical value. If the volume parameter and critical value are equal, the optimum wing is identical to that of the unconstrained volume. M.W.R.

N66-34888# Dynasciences Corp., Fort Washington, Pa.
CHARTS FOR ESTIMATING AERODYNAMIC FORCES ON STOL AIRCRAFT WINGS IMMERSED IN PROPELLER SLIPSTREAMS Final Report
K. P. Husng, L. Goland, and I. Balin Nov. 1965 81 p refs
(Contract NOw-64-0316-f)
(DCR-161; AD-634722) CFSTI: HC $3.00/MF $0.75

Equations and charts are presented for estimating the lift and longitudinal force coefficients of STOL aircraft wings immersed in propeller slipstreams. Sample calculations are made and the results show fair to good correlation with available experimental data. The effect of many design and operating parameters is analyzed. Author (TAB)

N66-34920# Library of Congress, Washington, D. C. Aerospace Technology Div.
AN APPROXIMATE NUMERICAL METHOD OF CALCULATING A THREE-DIMENSIONAL FLOW IN A STEAM-TURBINE STAGE Surveys of Soviet Scientific and Technical Literature
Bartholomew Poplawski 20 Apr. 1966 13 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 11, 1965 p 25–29
(ATD-66-48; AD-635171) CFSTI: HC $4.00/MF $0.50

To obtain a closed system of differential equations describing the motion of steam or gas through a stage of an axial-flow turbomachine, it is necessary to define additional conditions. The importance of the additional conditions as the main factors determining the design of the stage blades is shown. The equations of motion and continuity are written in terms of the heat drop and the geometric characteristics of the stage. This form of the expression permits the definition of the initial, boundary, and additional conditions, which are based on the available design experience, and the evaluation of the stage from the point of view of strength, and fabrication and economic requirements. The analysis of the problem of three-dimensional flow through a stage of an axial-flow turbomachine has shown that four types of problem formulation are possible and a certain solution method is necessary for each one. By solving the equations of motion and continuity simultaneously, the heat-drop derivative in the axial direction is eliminated, thus making it possible to reduce the solution of the problem to the solution of an ordinary first-order differential equation using the method of lines, since the hypothesis that the flow in the turbine is axisymmetric introduces a substantial error into the calculation results. A method is proposed which makes it possible to approximately account for the non-uniformity of the flow while retaining the mathematical advantages of the axisymmetric calculation technique. TAB

N66-34894*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AND SUPERSONIC AERODYNAMIC CHARACTERISTICS OF AN AIRPLANE CONFIGURATION UTILIZING DOUBLE-PIVOT VARIABLE-SWEEP WINGS
Edward C. Polhamus, William J. Alford, Jr., and Gerald V. Foster Washington, NASA, Dec. 1962 57 p refs
(NASA-TM-X-743) CFSTI: HC $3.00/MF $0.50 CSCL 01A (Declassified)

The double-pivot wing consists of a main wing and a fore wing, each pivoted within the fuselage in such a manner that unbroken leading and trailing edges are provided in both the low- and high-sweep positions. Tests were made at low subsonic speeds and at a Mach number of 2.20. The variation of longitudinal stability with wing sweep angle was similar to

that of an outboard-pivot wing and considerably less than that of a single-inboard-pivot wing tested with the same fuselage-tail arrangement. At low speeds the double-pivot wing provided better longitudinal, directional, and lateral stability at high angles of attack than the outboard wing-pivot arrangements tested on the same airplane model. Author

N66-34998*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUBSONIC AERODYNAMIC CHARACTERISTICS OF AN AIRPLANE CONFIGURATION UTILIZING A VARIABLE-SWEEP WING HAVING A FREE-FLOATING APEX

Edward C. Polhamus and Alexander D. Hammond Washington, NASA, Jul. 1965 36 p refs

(NASA-TM-X-1126) CFSTI: HC $2.00/MF $0.50 CSCL 01A (Declassified)

A low-speed wind-tunnel investigation has been made to determine the longitudinal characteristics of a variable-sweep airplane configuration which utilizes a free-floating wing apex as a means of alleviating some of the longitudinal stability and supersonic performance problems associated with variable-sweep airplanes. The results indicated that by allowing the wing apex to free-float, pitch-up could be eliminated without resorting to wing flow-control devices or special horizontal-tail locations. A large reduction in the longitudinal stability variation with sweep angle was also obtained which would provide for improved supersonic maneuverability and reduced trim drag. It was also shown that by proper design of the wing-apex trailing edge, subsonic cruise performance penalties and sudden trim changes associated with the free-floating apex can be avoided. Tests with the apex set at various fixed incidence angles allowed for the determination of floating angles and also indicated that pitch-up can be eliminated by use of wing-apex incidence. Author

N66-35033# Institut für Elektronen und Ionenforschung, Munich (West Germany).

EXPERIMENTAL INVESTIGATIONS ON A POSSIBLE DECOMPOSITION OF THE "PRANDTL BOUNDARY LAYER" BY MEANS OF THE "PANEL WIND" OF AN OSCILLATING SURFACE [EXPERIMENTELLE UNTERSUCHUNGEN ZU EINEM MOEGLICHEN ABBAU DER "PRANDTL'SCHEN GRENZSCHICHT" MITTELS DES "WANDWINDES" EINER SCHWINGENDEN FLAECHE]

U. Graf, K. Kugler, and A. Nikuradse Feb. 1966 19 p In GERMAN; ENGLISH summary

(DLR-FB-66-22) CFSTI: HC $1.00/MF $0.50

When the panel of a body is set into oscillation it is to be expected that the friction layer (Prandtl boundary layer) is "pumped away" by the "panel wind" arising under appropriate conditions. The experiments however showed the expected "pumping effect" of the oscillating panel only at ultrasonic frequencies. Supposing an average wind-pressure of $0.2 \cdot 10^{-3}$ Torr and an oscillating surface of 0.5 cm^2 (effective surface) the amount of air circulated was 2.5 cm^3/sec. Author

N66-35045# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Gasdynamik.

THREE-COMPONENT FORCE TESTS ON AGARD CALIBRATION MODELS B AND C IN THE AVA TRANSONIC WIND-TUNNEL [DREI-KOMPONENTENMESSUNGEN AN DEN AGARD-EICHMODELLEN B UND C IM TRANSSONISCHEN WINDKANAL DER AVA]

W. Schneider Feb. 1966 38 p refs In GERMAN; ENGLISH summary

(DLR-FB-66-10; AVA-FB-66-02) CFSTI: HC $2.00/MF $0.50

Three component force tests were conducted at the AVA in the Transonic wind-tunnel on AGARD calibration models B and C. Mach number range was from Ma=0.5 to Ma= 1.15. AGARD model B was tested too in the supersonic test section of the tunnel at Mach numbers Ma=1.52 and Ma= 1.97. Both models had 0.5-percent blockage. The Reynolds number was approximately $2.4 \cdot 10^6$. Test results are presented in form of diagrams and are compared with results of other wind tunnels. Author

N66-35048*# Wichita Univ., Kans.

AN EXPERIMENTAL INVESTIGATION OF THE FLOW FIELDS ABOUT DELTA AND DOUBLE-DELTA WINGS AT LOW SPEEDS

William H. Wentz, Jr. and Michael C. Mc Mahon Washington, NASA, Aug. 1966 145 p refs

(Grant NGR-17-003-003)

(NASA-CR-521) CFSTI: HC $4.00/MF $1.00 CSCL 01A

A low-speed wind tunnel investigation was conducted to determine the flow fields about delta and double-delta wings. Semi-span models consisting of a 62° sweep delta wing-body and a 75°/62° double-delta wing-body were tested at a Reynolds number per foot of 1.0×10^6. Detailed surveys of the three-dimensional velocity fields above the wings are presented. In addition, three-component force data, pressure distributions, surface tuft patterns and oil streak patterns are presented and discussed. It is concluded that the principal effect of the strake on the double-delta configuration is to increase the vortex strength over the wing, resulting in an increase in normal force developed for a given angle of attack. Author

N66-35123# David Taylor Model Basin, Washington, D. C.

EFFECT OF FOREBODY MODIFICATIONS ON THE AERODYNAMIC CHARACTERISTICS OF A SIMULATED AIRCRAFT STORE AT MACH NUMBERS FROM 0.60 TO 1.17

F. E. West, Jr. and H. Dulany Davidson, Jr. Mar. 1966 58 p refs

(DTMB-2175; DTMB-AERO-1103; AD-634736) CFSTI: HC $3.00/MF $0.50

An exploratory investigation was made of the effect of various forebody modifications on the longitudinal aerodynamic characteristics of a simulated low-drag aircraft store. Results were obtained at Mach numbers from 0.60 to 1.17 and angles of attack up to about 21°. Specifically, the effects of progressively sliding a cylindrical sleeve forward over the store forebody, eliminating the store forebody for various sleeve projections, and of disk spoilers on the forebody were explored. The results show that the static stability characteristics of the store were improved by modifications which induced flow separation at some position on the store forebody. The extent of the Mach number and angle-of-attack ranges where improvements occurred was a function of both the modification and store center-of-gravity position (which may shift with changes in the forebody). Author (TAB)

N66-35141# McGill Univ., Montreal (Quebec). Mechanical Engineering Research Labs.

AN APPLICATION OF VORTEX THEORY TO PROPELLERS OPERATING AT ZERO ADVANCE RATIO

I. S. Gartshore Jun. 1966 62 p refs

(Grant DRB-G-9551-12)

(TN-66-3) CFSTI: HC $3.00/MF $0.75

This note describes an application of lifting line theory to the problem of predicting the characteristics of propellers used at zero advance ratio. The complexity of the propeller wake geometry is reduced by assuming instantaneous rolling

up of part of the vorticity shed into the wake and by fixing the general form of the mathematical expression describing the wake position. These assumptions, together with some numerical constants based on experimental evidence, have been used in order to predict overall thrust and power for a propeller at zero forward speed. The result is a semi-empirical method, capable of further refinement, which is able to predict distributions of thrust and power on the blades in good qualitative and fair quantitative agreement with measured values of these quantities. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-34100*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MINIMUM DRAG OF FOUR VERSIONS OF A SWEPT-WING FIGHTER AIRPLANE OBTAINED FROM FLIGHT TESTS OF ROCKET-BOOSTED MODELS AT MACH NUMBERS FROM 0.81 TO 1.71

Earl C. Hastings, Jr. Washington, NACA, 7 Sep. 1956 32 p refs

(NACA-RM-L56E25a) CFSTI: HC $2.00/MF $0.50 CSCL 01B (Declassified)

Tests conducted with four specific versions of a swept wing fighter airplane indicate that a large reduction in external-drag coefficient was accomplished by redesigning the original configuration. The forebody modifications, which consisted of a smaller canopy, slimmer nose, and sharper inlet lip, reduced the value of the external-drag coefficient from 0.044 to 0.042 at a Mach number of 1.05 and from 0.042 to 0.040 at a Mach number of 1.28. Recontouring this modified fuselage by increasing the cross-sectional area ahead of and behind the wing to obtain a more efficient area distribution at a Mach number of 1.2 resulted in an additional drag reduction throughout the Mach number range of the tests. Values of external-drag coefficient from these tests were constant at 0.035 between Mach numbers of 1.05 and 1.71. The drag-rise Mach number for each configuration was 0.93. Author

N66-34101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LOW-SPEED INVESTIGATION OF THE EFFECT OF SMALL CANARD SURFACES ON THE DIRECTIONAL STABILITY OF A SWEPTBACK-WING FIGHTER-AIRPLANE MODEL

John W. Paulson and Peter C. Boisseau Washington, NACA, 23 Aug. 1956 26 p ref

(NACA-RM-L56F19a) CFSTI: HC $2.00/MF $0.50 CSCL 01C (Declassified)

A low-speed investigation has been made in a free-flight tunnel to determine the effect of small canard surfaces on the directional stability of a fighter-airplane model having an aspect ratio of 3.4 and a 42° sweptback wing. The canard surfaces were found to be generally ineffective at angles of attack below 20°. For higher angles of attack, small canard surfaces (4-1/2 by 27 inches, full scale) reduced the directional instability of the model at low angles of sideslip ($\beta < 6°$) but provided no improvement at higher angles of sideslip. These canard surfaces had virtually no effect on the longitudinal characteristics. Author

N66-34103*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF COMPONENTS AND VARIOUS MODIFICATIONS ON THE DRAG AND THE STATIC STABILITY AND CONTROL CHARACTERISTICS OF A 42° SWEPT-WING FIGHTER-AIRPLANE MODEL AT MACH NUMBERS OF 1.60 TO 2.50

James D. Church Washington, NACA, 15 Apr. 1959 167 p refs

(NACA-RM-L57K01) CFSTI: HC $3.25/MF $1.00 CSCL 01C (Declassified)

A wind tunnel investigation has been conducted of the drag and the static longitudinal and lateral stability and control characteristics of a 42° swept-wing fighter-airplane model. Data were obtained at Mach numbers of 1.60, 1.90, 2.20, and 2.50 at a Reynolds number of approximately 2.1×10^6 per foot, or 1.4×10^6 based on mean aerodynamic chord. Effectiveness of both longitudinal and lateral controls and the effects of model-component breakdown are presented. Changes in drag at zero lift caused by fixing transition and increasing Reynolds number were almost negligible. The complete model incorporating ventral fins was statically stable both longitudinally and directionally at all Mach numbers for angles of attack up to 19°. The effects on static stability of adding various external stores and a speed brake were relatively minor. Addition or extension of three semi-submerged missiles to the basic configuration progressively decreased the directional stability of the model. Body-mounted strakes improved the model directional stability at moderate and high angles of attack. Author

N66-34160# Army Aviation Materiel Labs., Fort Eustis, Va.

UH-1B HELICOPTER FLIGHT LOADS INVESTIGATION PROGRAM

Larry E. Clay, Joseph F. Braun (Technol., Inc.), David Chestnutt, and Louis R. Bartek May 1966 125 p ref Prepared jointly with Technol., Inc.

(USAAVLABS-TR-66-46; AD-634502) CFSTI: HC $4.00/MF $0.75

A 219-hour statistical sample of data was collected from UH-1B helicopters performing normal field mission assignments covering a period of 3 months. The parameters monitored were: airspeed, altitude, outside air temperature, acceleration at the aircraft center of gravity, main rotor rpm, collective stick position, longitudinal cyclic stick position, and engine torque. Supplementary information for each flight included barometric pressure, type of mission, and aircraft gross weight. The data are presented as frequency-of-occurrence histograms, exceedance curves, and gust spectra. These figures and curves may be used to establish design criteria for new helicopters and for modification of design criteria for existing aircraft. Author (TAB)

N66-34253# Sea-Space Systems, Inc., Torrance, Calif.

MER J II BALLOON FLIGHTS: HIGH ALTITUDE BALLOON RESEARCH Final Technical and Analysis Report

Dale W. Cox May 1966 16 p

(Contract Nonr-4776(00))

(SSS-6013; AD-634216) CFSTI: HC $1.00/MF $0.50

Three 4,500,000 cu ft MER J II balloons were fabricated and flown during this program. The balloons were produced

from very light weight, composite and plain balloon films. The tops of the balloons were made from Mylab reinforced composite film, while the bottom skirt employed .00032 in. thick plain Mylar film. Loadweb seam construction was used to provide adequate strength in supporting a 500 lb payload. The balloons were capable of a theoretical performance of lofting a 150 lb payload to an altitude of 150,000 ft or a 500 lb payload to 137,000 ft. The first balloon reached an altitude of 72,000 ft. The second unit was lost in a launch accident; and the third balloon was ascending at 150 fpm at 68,000 ft when it was intentionally terminated. An analysis of problems and suggested solutions are made. Author (TAB)

N66-34619# General Electric Co., Cincinnati, Ohio. Advanced Technology and Demonstrator Programs Dept.

GROUND VIBRATION TEST RESULTS: XV-5A LIFT FAN FLIGHT RESEARCH AIRCRAFT

Apr. 1966 107 p refs

(Contract DA-44-177-TC-715)

(Rept.-167; AD-635489) CFSTI: HC $4.00/MF $0.75

This report contains the results of the experimental investigation of the static and dynamic characteristics of the U.S. Army XV-5A lift fan research aircraft as pertaining to the flutter and vibration effort on the XV-5A aircraft. TAB

N66-34905# David Taylor Model Basin, Washington, D. C. Aerodynamics Lab.

SOME DESIGN PRINCIPLES OF GROUND EFFECT MACHINES, SECTION A: INTRODUCTORY SURVEY

Harvey R. Chaplin and Allen G. Ford Apr. 1966 31 p

(DTMB-AERO-212/A; AD-635512) CFSTI: HC $2.00/MF $0.50

Ground effect machine types and principles are reviewed, and development trends are examined. The 'hovercraft' and 'captured air bubble' types are chosen for detailed study in the succeeding reports of this series. Author (TAB)

N66-34847# Lear Siegler Service, Inc., Harrisburg, Pa.

ZERO-GRAVITY MANEUVER INSTRUMENTS AND INSTRUMENTATION Final Report, Apr. 1963-Apr. 1964

B. C. Dixon Wright-Patterson AFB, Ohio, AMRL, Feb. 1966 60 p refs

(Contract AF 33(657)-11107)

(AMRL-TR-66-1; AD-635066) CFSTI: HC $3.00/MF $0.75

The type ARU-2B/A attitude director indicator (ADI) system was evaluated as a pilot aid in flying a JC-131B aircraft on a ballistic trajectory to produce a zero- or reduced-gravity field. To provide an unburdened display to the pilot, all information necessary to fly a complete zero-G maneuver was presented on the ADI, except airspeed. A parabola control panel was designed to provide six modes of presenting normal acceleration data to the ADI; i.e., zero-G, sub-G, super-G, decay, float, and program modes. The modes were effective, except for the float and program modes which are still experimental. Data from 385 maneuvers at various gravity levels from 0 G to 0.75 G revealed that when flying gravity levels below 0.25G an accuracy of ±0.05G could be maintained. This is generally considered an acceptable parabola. However, when flying gravity levels greater than 0.25G the errors became greater than ±0.05G. As the desired gravity level is increased, the parabola time is increased and a high degree of accuracy is more difficult to maintain. In addition, the system errors were greater at the higher gravity levels. These two facts account for most of the errors at increased sub-gravity levels. The ARU-2B ADI system proved to be an effective aid in flying various sub-G, super-G, zero-G, and decay maneuvers. Author (TAB)

N66-34888# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

SINGLE ROTOR HELICOPTER DYNAMICS FOLLOWING POWER FAILURE AT HIGH SPEEDS Final Report

Dean E. Cooper, Knute C. Hansen, and Theddeus T. Kaplita Jun. 1966 261 p refs

(Contract DA-44-177-AMC-195(T))

(SER-50414; USAAVLABS-TR-66-30; AD-635128) CFSTI: HC $1.50/MF $1.25

The program was conducted to investigate the effects of a loss of power on a single rotor helicopter at high speeds. A normal mode flexible blade analysis was combined with generalized helicopter equations of motion on a hybrid computer to predict the effects of rotor design variables and corrective control inputs on the transient response of a helicopter following a loss of main rotor power. At high forward speeds (200 to 235 knots) a loss of power can seriously affect the safety of single rotor helicopters unless there is a rapid and appropriate application of main rotor and tail rotor control. Rotor propulsive force, hinge offset, and rotor blade inertia were found to be important design considerations which effect helicopter and blade motion and loading following a loss of power. The aircraft response is due primarily to the fuselage aerodynamic characteristics associated with the sideslip and yaw motion generated by the unbalanced tail rotor yawing moment. The loss of power is less critical when a partial loss of power occurs or for a reduced rotor propulsive force. Author (TAB)

N66-34888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.

ESTIMATION OF FLYING QUALITIES OF PILOTED AIRPLANES Final Report, 1960-1965

Robert J. Woodcock and Douglas E. Drake (Douglas Aircraft Co.) Apr. 1966 151 p refs Prepared in part by Douglas Aircraft Co.

(Contract AF 33(616)-6480)

(AFFDL-TR-65-218; AD-483622)

Methods, ranging from rigorous and complicated to simple and approximate, are presented for estimating flying qualities in accordance with such specifications as MIL-F-8785 (ASG). Aerodynamic and inertial data are assumed to be known. Intended mainly for design use, the report gives enough detail to indicate derivations and conditions for validity. Topics include the static and dynamic, controls-fixed and controls-free aspects of aircraft stability, control, and trim. Although emphasis is on linear analysis, methods are given or indicated for such nonlinear problems as drag, pitch-up, inertial coupling, and spinning. Appendixes give an introduction to aeroelastic effects, ways to analyze control tabs, a derivation of the controls-free equations of motion, and an introduction to root locus analysis. Author (TAB)

N66-35023# Civil Aeronautics Board, Washington, D. C.

U.S. GENERAL AVIATION Summary Reports of Accidents, May 16-31, 1966

31 May 1966 61 p

Summary reports are given of commercial and private aircraft accidents, including details on location, date, type of aircraft, aircraft damage, injury to crew and/or passenger, and probable cause. L.E.W.

N66-35031# National Opinion Research Center, New York.

COMMUNITY REACTIONS TO SONIC BOOMS IN THE OKLAHOMA CITY AREA. VOLUME II: DATA ON COMMUNITY REACTIONS AND INTERPRETATIONS Final Report, Apr. 1963-Feb. 1965

Paul N. Borsky Wright-Patterson AFB, Ohio. AMRL. Oct. 1965 315 p refs /its Rept.-101, Pt. 2
(Contract AF 33(657)-11148)
(AMRL-TR-65-37, Vol. II; AD-625332) CFSTI: HC $7.00/MF $1.50

During a period of six months from February to July 1964, the Oklahoma City, Oklahoma, area was repeatedly exposed to sonic booms generated to simulate overpressure levels that are expected for supersonic transport overflights. The schedule provided for eight sonic booms per day. During the six-month period, almost 3,000 local residents were interviewed three times to determine the nature and extent of their reactions to the sonic booms. This report contains a detailed description of the overall study design including the selection of households, selection of respondents, training and selection of interviewers and samples of questionnaires used during the interviews. Among the findings it was determined that ordinary living activities were often interrupted by sonic booms, but that a majority of the residents felt they could learn to live with the interruptions. A substantial number of residents felt they had sustained damages from the booms, although detailed engineering observations of structures in the area did not confirm most of these reports. As the intensity of the booms increased, acceptance of the booms by residents was reduced. Residents who felt that the development of a commercial supersonic airplane was important were more likely to accept the exposures to the sonic booms.
Author (TAB)

N66-35110# David Taylor Model Basin, Washington, D. C.
SOME DESIGN PRINCIPLES OF GROUND EFFECT MACHINES. SECTION B: AIR CUSHION MECHANICS
Harvey R. Chaplin and Allen G. Ford Apr. 1966 38 p
(DTMB-2121B; DTMB-AERO-1100B; AD-635468) CFSTI: HC $2.00/MF $0.50

The energy and momentum relationships governing air cushion performance are reviewed. The exponential-theory equations are recommended for calculation of cushion pressure and jet reaction, and a modified equation is proposed for calculation of the volume flow rate. The question of off-design cushion performance is discussed. It is pointed out that off-design performance is of paramount practical importance and that the widely held notion that peripheral jet cushions are more efficient than simple plenum cushions is not necessarily valid in this context. The danger of drawing erroneous conclusions from the cushion performance equations, which (except for the plenum) do not apply to off-design operation, is emphasized.
Author (TAB)

N66-35129# Aeronautical Research Inst. of Sweden, Stockholm.
THE "ALLOTMENT-OF-PROBABILITY-SHARES"—APS—METHOD, A GUIDANCE FOR FLIGHT SAFETY MEASURES
Bo Lundberg [1966] 27 p refs Presented at the Intern. Symp. on Civil Aviation Safety, Stockholm, 26–29 Apr. 1966
(PE-18)

Described is an essentially statistical approach to the safety problem of steadily increased air traffic and its expected increase in accident rates. The fundamental feature of the new method is to divide the maximum total risk corresponding to the flight safety goal into "probability shares" and to make the safety goal more stringent in pace with the predicted growth of aviation. Thus, probability shares are allotted to various groups of accident risks, subdivided into sub-shares to be, and in turn divided into sub-subdivisions, etc., for specific accident risks. The main function of this statistical safety problem relies on the identification of as many of the conceivable risks as possible which are statistically controllable.
G.G.

N66-35197*# National Aeronautics and Space Administration, Washington, D. C.
FIRST PLANETARY PARACHUTE TEST PLANNED AUGUST 29
26 Aug. 1966 9 p
(NASA News Release-66-225) Available from the Scientific and Technical Information Division CSCL 01B

The proposed series of high altitude experiments to investigate parachute designs and techniques for landing instrumented capsules on Mars is reported. Flight units of varying shapes and sizes are planned to be accelerated to determine how well different parachutes can be deployed behind them. The designs of the disk-shaped, first flight unit and its cylindrical payload are described, and the time schedule is presented.
N.E.N.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

03

N66-34248# Harry Diamond Labs., Washington, D. C.
HIGH-CURRENT PULSE GENERATOR FOR GALLIUM ARSENIDE LASER
William L. Soper Apr. 1966 14 p ref
(HDL-TM-66-3; AD-634507) CFSTI: HC $1.00/MF $0.50

A mercury wetted relay pulse generator and a pulse transformer have been built to drive gallium arsenide lasers in a fast pulse mode. The system is capable of 100-A subnanosecond rise-time pulses at 800-Hz repetition rates. The design and performance are discussed.
Author (TAB)

N66-34427*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CONTROL AND STARTUP CONSIDERATIONS FOR TWO-SPOOL SOLAR-BRAYTON POWER SYSTEM
Herbert G. Hurrell and Ronald L. Thomas Washington, NASA, Aug. 1966 19 p refs
(NASA-TM-X-1270) CFSTI: HC $1.00/MF $0.50 CSCL 10B

An analog computer simulation of a two-spool solar Brayton system was used to study the control requirements of this system for operation in a 300-n. mi. ecliptic earth orbit. Startup in orbit by injecting the gas inventory into the initially evacuated system was also investigated. The simulated system uses a radial-flow turbocompressor and an axial-flow alternator-drive turbine with a power output of 10 kW at design conditions. The working gas is argon, and the heat storage medium for shade operation is lithium fluoride. The results of the study indicate that an overtemperature control for the heat storage component is required in addition to the solar-collector-orientation control and the turbo-alternator speed, voltage, and overload controls. Closed-system, gas injection startups can be accomplished by directing cold gas into the absorber by using a check valve to prevent reverse flow, or by injecting hot gas (1250°R) at the inlet of

the compressor-drive turbine without a check valve. Over-design power usage from the heat storage component during startup with a cold radiator can be accommodated by starting during specific periods of the orbit. Author

N66-34472# General Electric Co., Lynn, Mass. Direct Energy Conversion Operation.

THERMOELECTRIC POWER GENERATION Quarterly Progress Report, 1 Jan.-31 Jul. 1962

30 Jul. 1962 58 p
(Contract NObs-86854)
(QPR-1; QPR-2; AD-634477) CFSTI: HC $5.60/MF $0.50

Progress is reported on the design, fabrication and evaluation of a lead telluride thermocouple cartridge. Mg_3Sb_2 prepared in a sealed bomb came within 1 atomic percent of exact stoichiometry but contained a Sb–Mg_3Sb_2 eutectic concentration of about 1.0% by volume. The room temperature thermal conductivities of several nearly stoichiometric specimens of Mg_3Sb_2 were measured by the Powell comparator method. The average of seven determinations made on four different specimens was .013 watt/cm°C vs a reported value of about .010 watt/cm°C for the thermal conductivity of the pure compound. The known volume concentrations of eutectic in the specimens fully account for the discrepancy. The room temperature thermal conductivity of Minnesota Mining and Manufacturing Company TEG-2P p-type PbTe, as measured in the same apparatus, is .023 watt/cm°C and it can be shown that the value for stoichiometric Mg_3Sb_2 doped to a resistivity of 10^{-3} ohm cm would be only about .012 to .013 watt/cm°C. On this basis, there seems to be reasonable promise that Mg_3Sb_2 can be developed into a superior p-type thermoelectric material. Author (TAB)

N66-34837*# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.

OPERATING INSTRUCTIONS, ALLIS-CHALMERS FUEL CELL POWER SYSTEM (SYSTEM NUMBER 5R)

6 Jun. 1966 147 p Prepared for NASA
(NASA-CR-77276) CFSTI: HC $4.00/MF $1.00 CSCL 10A

A manual of operating instructions is presented for an open loop fuel cell system. Preceding the instructions is a general description of the power system accompanied by diagrams and performance capabilities. Installation procedures include unpacking, inspection, assembly, and equipment checkout. Requirements for integrated system operation are discussed beginning with pre-startup conditioning and warmup through abnormal operation and emergency shutdown. Among the other areas described are fuel stack, moisture removal, and electrical monitoring and control subsystems. Thermocouple instrumentation is also reviewed. S.P.

N66-34784# Radio Corp. of America, Lancaster, Pa. Direct Energy Conversion Dept.

THE DEVELOPMENT OF A FLAME FIRED THERMIONIC GENERATOR Summary Technical Report, 15 Mar. 1965–15 Apr. 1966

[1966] 95 p refs
(Contract DA-44-009-AMC-998(T))
(ERDL-998T-2; AD-634538) CFSTI: HC $3.00/MF $0.75

The report covers a program to investigate components for flame fired thermionic energy conversion systems. The objective of the program is to demonstrate the feasibility of integrating a thermionic converter with a barrier layer and a heat pipe to obtain 1500 hour reliability of the assembly. A basic subassembly was designed to deliver 100 electrical watts from the thermal energy of a fossil fuel flame operating in an air environment. Twelve of these units would be used in the one kilowatt power module. Problems of heat transfer, permeation barrier integration, heat pipe processing and closure, and burner temperature uniformity were encountered and substantially reduced or eliminated. After the separate components were evaluated and determined to be satisfactory, A fossil fuel-heated converter was assembled which delivered 100 watts of power during testing. Author (TAB)

N66-34888# Radio Corp. of America, Somerville, N. J. Electronics Components and Devices.

STRUCTURES FOR 300-WATT, 400MHz UHF POWER TRANSMISSION Interim Technical Report, Jan. 1–Mar. 31, 1966

F. Katnack, R. Minton, D. Jacobson, and R. Rosenzweig Jan. 1966 55 p refs
(Contract AF 33(615)-3202)
(ITR-2; AD-634744) CFSTI: HC $3.00/MF $0.50

Capacitance measurements are presented for integral- versus wire-bonded leads. The measurements indicate a 20 percent reduction in C_{ob} because of the elimination of the bonding areas. A package design is presented which allows the assembly of integral lead devices in a modified TO-60 case. Electrical measurements are given for devices which have buried diffused N+ conductance plugs. The results show the expected decrease in capacitance but also show a loss in rf power output. This loss has been attributed to a residual high-resistivity region under the periphery of the emitter. Wafers have also been processed by a modified refill-method to form N+ plugs. This technique utilizes a refill with high-resistivity silicon in areas surrounding each emitter site, and has the advantage of allowing emitter diffusion to be performed in the original bulk silicon. Three types of failures, produced under dc and rf test conditions, were observed on the TA2657 transistor. Illustrations and visual characteristics of each type of failure are given. Design considerations of thin-film inductors as well as measurements on two experimental coil designs are presented. MOS capacitors were constructed and values are given for capacitance versus voltage and oxide thickness. The theory of operation for and the circuitry of a distributed line amplifier are discussed. Power outputs of 36 watts at 400 MHz have been achieved by four 2N3632 transistors in this circuit. Author (TAB)

N66-34888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.

SEALED NICKEL-CADMIUM BATTERIES FOR AIRCRAFT ELECTRICAL SYSTEMS

Gerald H. Miller [1966] 14 p refs Presented at the IEEE Aerospace Systems Conf., Seattle, 11–15 Jun. 1966
(AFAPL-CONF-66-6; IEEE-A13; AD-634845) CFSTI: HC $1.00/MF $0.50

Adapting sealed batteries to aircraft electrical systems is feasible. The major problem to be solved is the development of a suitable charge conditioner to operate with the battery and the aircraft electrical system. The interchanging of vented-cell, nickel-cadmium aircraft batteries with sealed-cell, nickel-cadmium aircraft batteries is considered possible by mid-1968. The major advantages of sealed-cell aircraft batteries are improved flight safety, maintenance-free operation, and improved performance in terms of life and reliability. Author (TAB)

N66-34896# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SILICON SOLAR BATTERIES [KREMNIYEVYYE SOLNECHNYYE BATAREI]

A. Ya. Gliberman and A. K. Zaytseva 19 Jan. 1966 84 p refs Transl. into ENGLISH of "Kremniyevyye Solnechnyye Batarei" Moscow, Gosenergoizdat., 1961 /tr Iss. 396
(FTD-MT-64-204; AD-634810) CFSTI: HC $3.00/MF $0.75

The pamphlet presents physical principles of work of silicon solar energy photoelectric converters. Considered are electrical and spectral characteristics of instruments and factors affecting magnitude of converter efficiency. Peculiarities of use of solar batteries are characterized. A number of constructions of batteries are described and examples are given of their application in different areas of science and technology.

Author (TAB)

N66-34896# Frankford Arsenal, Philadelphia, Pa. Propellant Actuated Devices Div.
NEW FUNDAMENTAL MECHANISM FOR AN ENERGY CONVERSION DEVICE Technical Research Report, 1 Jul. 1962–31 Jul. 1965
Frank T. Pisano Apr. 1966 57 p
(FA-R-1812; AD-635007) CFSTI: HC $3.00/MF $0.50

This report summarizes the theoretical and experimental studies conducted on a hot gas motor, a fundamentally new mechanism, as an energy conversion device. In the theoretical study, the relationship of the working components was determined and optimized for maximum conversion of fluid potential and kinetic energy into useful mechanical work. A test model of the hot gas motor was fabricated and a limited series of test runs was conducted, using both cold and hot gas. This report also presents a design discussion, a vector analysis, and test data of this novel motor. Author (TAB)

N66-35046*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALOG COMPUTER STUDY OF TEMPERATURE GRADIENTS OF A SOLAR COLLECTOR IN ECLIPTIC EARTH ORBIT
Ronald L. Thomas Washington, NASA, Sep. 1966 31 p refs
(NASA-TM-X-1282) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Temperature gradients required for analysis of surface distortions of a 20-foot-diameter magnesium solar collector operating in a 300-nautical-mile ecliptic Earth orbit were determined by means of analog computer simulation. Temperature gradients were determined for the surface sections formed by the collector's supporting ribs; in addition, temperature gradients radially across the collector were determined. The computer program used and the information obtained are discussed. For the surface section study, the heat inputs were functions of orbit position and were considered uniform across the section. Six surface conditions and five surface section sizes and rib depths were studied. Of the six surface conditions studied, the polished metal front with insulated back resulted in the lowest maximum temperature gradients. The temperature gradients across the surface sections and from sections to adjacent ribs were nearly constant for different surface section sizes with the same rib depth. The gradients were found to vary primarily with rib depth. For the radial temperature gradient study, the heat inputs to the collector were functions of position on the collector as well as collector position in orbit. Temperature distributions were determined along two adjacent ribs of different thicknesses. Results indicate typical radial temperature gradients of approximately 0.27° and 0.17°F per inch for the 0.120- and 0.380-inch-deep radial ribs, respectively. Comparisons of the two radial studies indicates that the maximum circumferential gradient could reach 0.925°F per inch between inner mirror sections (neglecting conduction). Author

N66-35146# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Aero Propulsion Lab.
DENDRITIC SILICON SOLAR CELLS AND UTILIZATION EXPERIENCE
Joseph Wise [1966] 28 p refs Presented at the IEEE Aerospace Systems Conf., Seattle, 11–15 Jul. 1966
(AFAPL-CONF-66-7; IEEE-A25; AD-634882) CFSTI: HC $1.00/MF $0.50

The method of fabrication for dendritic silicon solar cells of 30 sq centimeters is described; both conventional N on P and N on P drift-field cells are included. The N on P cells are formed through diffusion of phosphorus on the top surface; the drift-field cells, through epitaxial growth of a 40-micron layer on a segment of dendritic silicon web material followed by phosphorous diffusion, anti-reflection coatings, and integral quartz coatings. Experience in fabricating these cells and in utilizing them on a flexible array is summarized and their potentials for lower weight, longer life, and lower cost are assessed; space performance estimates also are included. The use of the ion implantation junction formation in the fabrication of highly efficient, thin dendritic silicon solar cells also is outlined. Measurements accomplished at the Air Force Aero Propulsion Laboratory on the various cell types are included. Author (TAB)

N66-35156# Yardney Electric Corp., New York.
DEVELOPMENT OF THE HIGH RATE METAL–AIR DEPOLARIZED BATTERIES Quarterly Report No. 2, 1 Oct.–31 Dec. 1965
Allen Charkey Ft. Monmouth, N. J., Army Electron. Labs., Jun. 1966 64 p refs
(Contract DA-28-043-AMC-01814(E))
(ECOM-01814-2; AD-635490) CFSTI: HC $3.00/MF $0.75

The investigation of the magnesium anode included a study of several electrolytes to determine compatibility with both electrodes. In all cases, best performance was obtained in a 'free' electrolyte system. The magnesium–air test cells, used only for exploratory studies, delivered specific energies of 50–55 Watt-hrs./lb. The investigation of calcium, aluminum, and barium air systems is still in an early exploratory stage. Particular interest however, is being given to calcium in an organic-aqueous-electrolyte with various corrosion inhibiting agents. Heat transfer by means of air convection was studied over the entire temperature range (−25 to +120°F) for the 2C through the C/50 rate of discharge. The testing units employed the zinc–air couple, but the heat transfer and air convection data are suitable for any metal–air battery design. This experimental investigation also indicated that low temperature bootstrap heating operation will be feasible for a zinc–air-battery. TAB

N66-35215*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPARISON OF LIQUID-METAL MAGNETOHYDRODYNAMIC POWER CONVERSION CYCLES
E. Weinberg and L. G. Hays 15 Aug. 1966 38 p refs
(Contract NAS7-100)
(NASA-CR-77551; JPL-TR-32-946) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Various two-phase liquid-metal magnetohydrodynamic power conversion cycles employing either a separator or jet condenser are compared on the basis of cycle efficiency, prime radiator area, and specific weight. The cycles are investigated from the standpoint of coalescence on a wall with attendant friction and deflection energy losses and, from the standpoint of liquid coalescence with no friction or deflection energy

losses. The results for the first condition show that the two-component cycles, both separator and condenser (employing lithium and cesium), have efficiencies of 6 to 7%, while the single-component (cesium or potassium) have maximum efficiencies of only 3 to 4%. The two-component separator cycle (cesium–lithium) has a slightly higher efficiency and smaller radiator area than the two-component condenser cycles (cesium–lithium), if 100% liquid impingement is assumed on the condenser and separator walls. For the second condition it was shown that the two-component cycles require about half as much radiator area as the single-component cycles. The efficiency of the two-component condenser cycles (cesium–lithium) increases indefinitely with decreasing rejection temperature, while the efficiency of the two-component separator cycle (cesium–lithium) is limited to 13%. The most promising cycle is the two component (cesium–lithium) separator cycle, if 100% liquid impingement occurs on the walls of the jet condenser and on the separator. Author

N66-35218*# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
RESEARCH AND DEVELOPMENT OF A HIGH CAPACITY, NONAQUEOUS SECONDARY BATTERY Final Report, Oct. 1964–Dec. 1965
R. G. Selim, K. R. Hill, and M. L. B. Rao 14 Feb. 1965 235 p refs
(Contract NAS3-6017)
(NASA-CR-54969) CFSTI: HC $3.75/MF $1.50 CSCL 10C

Some of the basic problems and fundamental limitations involved in the development of high energy density secondary cells are described. Special attention is given to the fundamental electrochemical problems peculiar to the lithium electrode. The basic theory of electrochemical measurement in poorly conducting solutions, in the total absence of supporting electrolyte, has been re-examined, with discussion based on concommitant experimental work. Cathodes, particularly CuF_2 and AgCl have been studied. The major problems concern the elementary electrochemical processes and the basic chemistry of the cathode salt–electrolyte systems; these problems are discussed and illustrated by experimental data. A detailed analysis of cell design criteria is presented, and the relevance of specific chemical and electrochemical processes to such criteria discussed. Author

N66-35250# Mechanical Technology, Inc., Latham, N. Y.
EXPERIMENTAL TEST AND EVALUATION OF A GAS-BEARING BRAYTON CYCLE TURBOCOMPRESSOR Quarterly Progress Report, 1 Dec. 1965–28 Feb. 1966
P. W. Curwen 4 Mar. 1966 59 p refs
(Contract AT(30-1)-3237)
(MTI-66TR14; NYO-3237-5) CFSTI: HC $3.00/MF $0.75

A Brayton cycle gas generator (turbocompressor) utilizing self-acting gas bearings was designed, built, and is now under test. Self-sustained closed-loop operation of the turbocompressor, using its own cycle gas as the bearing lubricant, was achieved in November 21, 1964. Through February, 1966, the turbocompressor has been successfully operated with nitrogen. The turbocompressor was also operated under "no-load" and "load" conditions in argon at turbine inlet temperatures up to 1323°F. A second failure of an electrical resistance element in the test-loop heater occurred during one of the argon tests. In order to obtain some insight into the reasons for these failures, the heater was completely disassembled, examined, repaired, and reinstalled during January and February of 1966. The turbocompressor, which is now equipped with a chrome-oxide surfaced thrust bearing, is presently being reinstalled in the loop. Additional loop testing should commence early in March. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-34175# Maryland Univ., College Park. Inst. of Fluid Dynamics and Applied Mathematics.
MIGRATION AND TRAPPING OF EXCITATION QUANTA IN PHOTOSYNTHETIC UNITS
Robert M. Pearlstein (Ph.D. Thesis) Jun. 1966 110 p refs
(Contract Nonr-595(22))
(BN-453; AD-634537) CFSTI: HC $4.00/MF $0.75

The migration and trapping of excitation quanta in photosynthetic units are treated as a problem of the transport of localized excitons through molecular networks. One, two, and three dimensional networks are treated as distinct cases. For the most part, attention is restricted to regular lattices, and all but nearest neighbor interactions are neglected. The latter are characterized by a single rate constant for ordinary molecule and a trapping center, or trap. It is pointed out that results for those finite networks explicitly considered apply also to infinite systems with periodic traps. TAB

N66-34178# Tracor, Inc., Austin, Tex.
STUDIES OF BINAURAL INTERACTION Summary Report, 1 Apr. 1965–31 Mar. 1966
Bruce H. Deatherage [1966] 127 p refs
(Contract Nonr-4123(00))
(TRACOR-66-311-U; AD-634344) CFSTI: HC $4.00/MF $0.75

Experiments with dimensional models of the cochlea and studies of auditory localization showed that tone bursts and impulsive stimuli (clicks) are processed differently by the auditory system. The purpose of these experiments was to examine this difference as a function of frequency coding in the ear. TAB

N66-34188*# California Univ., Los Angeles. Brain Research Inst.
HETEROSENSORY AND HETEROCORTICAL ACTIVATION OF THE PURKINJE NEURON
C. Batini [1966] 42 p refs
(Grant NsG-237)
(NASA-CR-77244) CFSTI: HC $2.00/MF $0.50 CSCL 06P

Convergence of heterogeneous afferents appearing at the single neuron level in the cerebellar cortex was investigated. Steel microelectrodes were used for recording the unitary potential in the extracellular field of the Purkinje neuron as well as of the granular cell. Response to phasic activation indicated that the three sensor afferent pathways may converge on the single Purkinje neuron through the polysynaptic intracerebellar circuit activated by the mossy fiber afferents. A second spike response in the Purkinje neuron records and shortly delayed from the mossy fiber's response is attributed to the climbing fiber afferents, producing a monosynaptic activation. Paired cortical and peripheral stimuli devliered at varying intervals show that intracerebellar polysynaptic inhibitory system may be activated by more peripheral stimulations. The present work led to the hypothesis that cortical and peripheral cerebellar afferents studied here may feed into precerebellar stations of convergence, which would be the sources of the mossy and climbing fibers. N.E.N.

N66-34214# School of Aerospace Medicine, Brooks AFB, Tex.
A METABOLIC ASPECT OF THE EFFECT OF ALTITUDE ON D-AMPHETAMINE IN THE RAT. Progress Report (Preliminary), Oct. 1965–Jan. 1966
Albert T. Bernardini Apr. 1966 10 p refs
(SAM-TR-66-42; AD-634054) CFSTI: HC $1.00/MF $0.50

Measurement was made of unchanged d-amphetamine excreted in urine from rats at a simulated altitude of 18,000 feet with 46% environmental oxygen maintained. Findings indicated no significant difference when compared to amphetamine in urine from rats injected with amphetamine at ground level. Author (TAB)

N66-34222# School of Aerospace Medicine, Brooks AFB, Tex.
PHYSIOLOGIC CHEMISTRY OF THE HUMAN ORAL SECRETIONS. TOTAL PROTEIN CONTENT OF PAROTID FLUID COLLECTED WITHOUT EXOGENOUS STIMULATION Final Report, Jun. 1964–Jun. 1965
Ira L. Shannon and James M. Terry Mar. 1966 18 p refs
(SAM-TR-66-30; AD-634574) CFSTI: HC $1.00/MF $0.50

Parotid fluid was collected without exogenous stimulation from 508 systemically healthy young adult males. The total protein content of this fluid, along with serum from simultaneous blood collections, was determined and correlations were sought with oral health status. Serum protein was not related to either caries experience or periodontal status. An insignificant relationship was found between serum protein and parotid fluid protein. This was true when parotid fluid protein was expressed in either concentration or secretion rate in micrograms per minute. Parotid fluid protein was not significantly related to wither of the oral health variables. Parotid flow rate was negatively related to parotid fluid protein concentration (R=−.287) and positivly related to the secretion rate for this constituent (R=.674). Each of these coefficients was different from zero at the .01 level. Author (TAB)

N66-34229# Army Foreign Science and Technology Center, Washington, D. C.
EFFECT OF HIGH DOSES OF GAMMA RAYS OF Co^{60} ON POTATO STARCH
S. E. Traubenberg, K. A. Korotchenko, and I. N. Putilova Jun. 1966 12 p refs Transl. into ENGLISH from Izv. Vysshikh Ucheb. Zavedenii, Pishchevaya Tekhnol. (Krasnodar), no. 6, 1965 p 24–28
(FSTC-HT-23-106-66; TT-66-61515; AD-634415) CFSTI: HC $1.00/MF $0.50

Experimental data are presented on high dosage irradiation of potato starch using Co^{60}. Doses up to 94 mrad were used and dissociation products were analyzed. Free radicals were found to exist for extended periods in irradiated potato starch. Author (TAB)

N66-34242# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METABOLIC PHYSIOLOGY OF MICROORGANISMS AND THE EVOLUTION OF FUNCTIONS
V. N. Shaposhnikov 17 Feb. 1966 220 p refs Transl. into ENGLISH of the book "Fiziologiya Obemna Veshchestv Mikroorganizmov v Svyazi s Evolyutsiyey Funktsiy" Moscow, Izd. Akad. Nauk SSR, 1960 183 p
(FTD-TT-65-616; TT-66-61404; AD-633666) CFSTI: HC $6.00/MF $1.25

Contents: Scientific Terminology; Physiological and Biochemical Characteristics of Microorganisms; Carbon Dioxide in Metabolism: (a) Photosynthesis; (b) Heterotrophic Photoassimilation; (c) Autotrophic Chemosynthesis; (d) Heterotrophic Chemoassimilation of Carbon Dioxide; Autotrophic and Heterotrophic Form of Life; Heterotrophic Form of Life. Some Moments in the History of the Development of Fermentation Studies; Homofermentative Lactic Acid Fermentation; Interrelation of Fermentative Processes with Constructive Metabolic Processes; Heterofermentative Lactic Acid Fermentation; Butyric Acid Fermentation; Condensation Reactions in Fermentations; Practical Importance of Di-Phase Metabolism in Microorganisms; Participation of Molecular Oxygen in Metabolism; Biological Oxidation. TAB

N66-34266# Army Medical Research and Nutrition Lab., Denver, Colo. Physiology Div.
HEMODYNAMIC ALTERATIONS IN HUMANS AND ANIMALS DURING CHRONIC HIGH ALTITUDE EXPOSURE
James A. Vogel, James E. Hansen, and John P. Hannon Jun. 1966 14 p refs
(AD-634647) CFSTI: HC $1.00/MF $0.50

It is concluded from these studies that the heart and circulation are capable of meeting the demands of oxygen delivery during heavy work at altitudes up to 14,000 ft. There was no evidence of any deleterious effect on the circulatory system nor of any reduced efficiency in the heart's action. Even though maximum performance is reduced at this elevation, it does not appear that the heart and circulation are responsible. Lastly, it can be recommended that gradual ascent to high elevation will be definitely advantageous from the standpoint of the cardiovascular system since it will significantly reduce the work load imposed upon the heart, particularly during the early stages of acclimatization when other problems such as pulmonary edema and altitude sickness are most apt to be prominent. Author (TAB)

N66-34273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOXIC EFFECT OF HIGH OXYGEN PRESSURES ON THE LIVING ORGANISM. REPORT 3: NATURE OF SPASMODIC GASES IN WARM BLOOD ANIMALS, SUBJECTED TO THE EFFECT OF HIGH OXYGEN PRESSURES
S. I. Prikladovitskiy 17 Feb. 1966 24 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 20, no. 3, 1935 p 507–517
(FTD-TT-65-966/1+2+4; AD-633773) CFSTI: HC $1.00/MF $0.50

A high oxygen partial pressure has various effects on young white mice depending upon their age. The intraperitoneal, subcutaneous and intracapital introduction of wormtree essence in adult white mice causes the appearance of spasms analogous to the ones which are detected during intravenal injection of the preparatus into dogs. The 'threshold' dosage of wormtree amounts for adult white mice is 0.025 g per 100 g of animal weight. Young white mice react to intraperitoal injection of wormtree differently, depending upon age. An intraperitoneal introduction of strychnine solution (1:2000) in white mice causes accidents of typical strychnine pains. Three age brackets for the irritation of the cortex by electrical and chemical irritants can be established in white mice. These results confirm the assumption that spasms, which appear in warm blooded animals under the effect of high partial oxygen pressures, are the result of an irritation in the cerebral cortex. TAB

N66-34295# California Univ., Los Angeles. Western Management Science Inst.
A MODEL OF INFORMATION ACQUISITION AND ORGANIZATION

Earl B. Hunt Mar. 1966 30 p refs *Its* Working Paper No. 97 (Contract Nonr-233(75)) (AD-633562) CFSTI: HC $2.00/MF $0.50

Neurophysiological studies have shown the existence of a variety of feature detectors in sensory branches of the nervous system. Psychopharmacological studies have shown that a variety of stimulants can be used to enhance learning in a way that is best explained by assuming that they act directly upon storage of the memory trace. A model of discrimination is proposed which incorporates the existence of feature detectors and uses them, plus associated postulates, to derive a facilitory effect of stimulant drugs upon memory. The model's implications for more complicated memory situations, such as the problems studied in human verbal learning, are also considered. Author (TAB)

N66-34306# Chicago Univ., Ill.

INVESTIGATIONS IN THE FIELD OF RELATIONAL BIOLOGY Final Report, Oct. 1, 1963–Mar. 31, 1966

Robert Rosen 20 May 1966 6 p refs (Grant AF-AFOSR-9-64) (AFOSR-66-0956; AD-634283) CFSTI: HC $1.00/MF $0.50

The studies are concerned with the structure and properties of a class of relational models of simple organisms. Some important problems relating to the behavior of these systems in altering environments are related to the properties of associated sequential machines and thence to control problems in dynamical systems. Questions of realizability of these abstract systems are considered in some detail, and the formulation of a general optimality principle, which would allow us to relate the abstract model to specific physicochemical realizations (i.e., real organisms) is discussed. Some implications of this study, both for important problems in biology, and for the study of nonbiological (i.e., engineering or extraterrestrial) realizations of biological organizations are described. Author (TAB)

N66-34319# Joint Publications Research Service, Washington, D. C.

STUDIES IN PHYSIOLOGICAL REACTIONS OF HUMANS AND ANIMALS TO SPACE FLIGHT

29 Jul. 1966 37 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 3, May–Jun. 1966 (JPRS-36733; TT-66-33164) CFSTI: $2.00

CONTENTS:

1. FUNCTION OF THE HUMAN ACOUSTIC ANALYZER AFTER EXPOSURE TO CORIOLIS ACCELERATIONS OF DIFFERENT VALUES Yu. V. Krylov p 1–5 refs (See N66-34320 20-04)

2. PHYSIOLOGIC REACTIONS OF COSMONAUTS TO THE ACTION OF ACCELERATION DURING THE FLIGHT OF THE SPACESHIP "VOSKHOD" A. R. Kotovskaya, N. Kh. Yeshanov, R. A. Vartbaronov, and S. F. Simpura p 6–21 refs (See N66-34321 20-04)

3. PATHOMORPHOLOGIC CHANGES IN HEMOPOIETIC ORGANS OF MICE EXPOSED TO THE COMBINED EFFECT OF SEVERAL KINDS OF IONIZING RADIATION AND DYNAMIC SPACE FLIGHT FACTORS N. A. Gaydamakin, V. G. Petrukhin, V. V. Antipov, P. P. Saksanov, and V. C. Shashkov p 22–33 refs (See N66-34322 20-04)

N66-34320# Joint Publications Research Service, Washington, D. C.

FUNCTION OF THE HUMAN ACOUSTIC ANALYZER AFTER EXPOSURE TO CORIOLIS ACCELERATIONS OF DIFFERENT VALUES

Yu. V. Krylov *In its* Studies in Physiol. Reactions of Humans and Animals to Space Flight 29 Jul. 1966 p 1–5 refs (See N66-34319 20-04) CFSTI: $2.00

The human physiological response on the vestibular apparatus following Coriolis accelerations was studied for use in the scientific determination of artificial gravity to be created in space vehicles. The reaction of the acoustic analyzer to Coriolis accelerations in a slowly revolving chamber was studied, and masking thresholds determined in order to study the function of hearing. It was concluded: (1) Twenty-four hours' confinement of human beings in a small chamber gives rise to fluctuations in acoustic sensitivity ranging from 10 to 12.5 dB. (2) Twenty-four hours' continuous rotation of human beings in a small chamber at an angular velocity of 5.3 deg/sec has no significant effect on the fluctuations in acoustic sensitivity. (3) Twenty-four hours' continuous rotation of human beings in a small chamber at an angular velocity of 10.6 or 21.2 deg/sec causes changes in acoustic sensitivity of 12.5 to 25 dB. R.Li.

N66-34321# Joint Publications Research Service, Washington, D. C.

PHYSIOLOGIC REACTIONS OF COSMONAUTS TO THE ACTION OF ACCELERATION DURING THE FLIGHT OF THE SPACESHIP "VOSKHOD"

A. R. Kotovskaya, N. Kh. Yeshanov, R. A. Vartbaronov, and S. F. Simpura *In its* Studies in Physiol. Reactions of Humans and Animals to Space Flight 29 Jul. 1966 p 6–21 refs (See N66-34319 20-04) CFSTI: $2.00

The physiological response to acceleration during the Voskhod manned spacecraft flight was investigated. Results obtained indicate that: (1) Cosmonaut physiological reaction during flight to the effects of g strain differed little from that observed in centrifuge rotation. (2) A 24-hour stay of three cosmonauts under conditions of weightlessness did not lead to an essential change in the level of tolerage to g strain arising from the return of the ship to earth. (3) Compared to centrifuge rotations, cosmonaut physiological reactions to g strain effects during descent to earth showed few individual peculiarities. (4) The preliminary preparation of the cosmonauts in the centrifuge was sufficient for satisfactory endurance of g strain under flight conditions. R.Li.

N66-34322# Joint Publications Research Service, Washington, D. C.

PATHOMORPHOLOGIC CHANGES IN HEMOPOIETIC ORGANS OF MICE EXPOSED TO THE COMBINED EFFECT OF SEVERAL KINDS OF IONIZING RADIATION AND DYNAMIC SPACE FLIGHT FACTORS

N. A. Gaydamakin, V. G. Petrukhin, V. V. Antipov, P. P. Saksanov, and V. C. Shashkov *In its* Studies in Physiol. Reactions of Humans and Animals to Space Flight 29 Jul. 1966 p 22–33 refs (See N66-34319 20-04) CFSTI: $2.00

The effects of ionizing radiation combined with vibration and acceleration factors are studied from the pathomorphologic changes seen in the spleen and bone marrow of 246 male mice. Experimental conclusions indicate that: (1) The combined action on mice of ionizing radiation-protons or gamma-rays, with vibration or acceleration, usually changed the degree of expression and character of pathomorphologic changes in the blood-forming organs. (2) The preliminary action of vibration three days and especially one day before radiation increased the destruction of the blood-forming organs. (3) The subsequent action of vibration three or especially five days after radiation markedly increased destructive changes in the blood-forming organs. R.Li.

N66-34342# Rochester Univ., N. Y. School of Medicine and Dentistry.
Fe-59 AND Cr-51 STUDIES OF THE EFFECT OF PARTIAL-BODY X-IRRADIATION ON ERYTHROPOIESIS IN BEAGLES
Vincent Thomas Penikas (Ph.D. Thesis) 1966 256 p refs
(Contract AF 33(608)-1272)
(AD-633201) CFSTI: HC $6.00/MF $1.25

In beagle dogs that received partial-body exposures of 1000 KvP X-rays, alternations in erythropoietic activity were studied using Fe-59 as a tracer. Cr-51 was used to estimate erythrocyte life span and the rate of loss on red cells from the circulation following exposure. Three groups of dogs were exposed to 1700 R to the upper-body, one group to 400 R to the upper-body, one group to 400 R to the lower-body, and a sham-irradiated group was used as a control. In an attempt to determine the degree of erythropoietic activity in the irradiated bone marrow during the period of rapid recovery after an upper-body exposure to 1700 R, two groups received an additional exposure of 400 R to either the upper or lower-body 14 days after initial 1700 R exposure. Ferrokinetic data among the various groups were analyzed and compared. TAB

N66-34344# Virginia Univ., Charlottesville. Biochemical Lab.
RED BLOOD CELL PRESERVATION Progress Report, 1 Jul. 1965–30 Jun. 1966
Alfred Chanutin 30 Jun. 1966 64 p refs
(Grant DA-MD-49-193-65-G162)
(AD-633970) CFSTI: HC $3.00/MF $0.75

A number of erythrocyte phosphate metabolites (adenosine tri- and diphosphates, guanosine triphosphate-, 2,3-diphosphoglycerate) affected heme-heme interaction and oxygen affinity with hemoglobin which resulted in a shift of the oxyhemoglobin dissociation curve to the right. In addition, tripolyphosphate, and tetra- and hexametaphosphates, particularly the latter, affected the dissociation curve in the same manner. Adenosine monophosphate and ribose-5-phosphate had no effect. These results, which are preliminary, were obtained with hemolysates and purified hemoglobin. Bloods, collected in ACD (pH 5.0) and CPD (pH 5.75) with and without additives, were stored in the cold (4°C) for six weeks. After 0, 2, 4, and 6 weeks storage, the erythrocytes were assayed for DPG, ATP, ADP, AMP, IMP, TPN and GTP by ion exchange chromatography. The ATP of red cells in stored unsupplemented blood was maintained at higher concentrations than those stored in CPD blood; DPG levels were greater in CPD blood. These differences were due to the pH of the blood. The remaining compounds were not appreciably changed during storage. In ACD blood supplemented with small amounts of adenine (0.05 to 0.10 mmole/100 ml), the ATP concentrations were higher than in those which contained greater amounts of adenine (0.5 mmole). The DPG values decreased rapidly in these bloods. Author (TAB)

N66-34503# Joint Publications Research Service, Washington, D. C.
ON THE ACCURACY OF PSYCHIC REFLECTION OF CHARACTERISTICS, AND ON THE THRESHOLDS OF SENSATIONS AND THRESHOLDS OF PERCEPTION
V. Ya Dymerskiy *In its* Cybernetics and Automation 17 Aug. 1966 p 152–166 (See N66-34496 20-05) CFSTI: $6.00

Sensations and perceptions are examined as two types of a sensory reflection of object characteristics and reality. Sensations are regarded from a quantitative standpoint as psychic measurements, and their accuracy is based on the respective threshold of discrimination. The process of perception represents a psychic calculation of values of a characteristic based on sensations of other characteristics and reflection of functional dependences. An example is proposed to illustrate the accuracy of reflection. Values of the differential threshold of perception are also determined with a concrete example. The psychological data are deemed important for use in engineering psychology, professional training, and simulator development. S.P.

N66-34530# School of Aerospace Medicine, Brooks AFB, Tex.
PREDICTION OF EYE SAFE SEPARATION DISTANCES Technical Report, Jan.–Feb. 1966
Everett O. Richey Jun. 1966 28 p refs Presented at the AGARD Symp. on Loss of Vision from High Intensity Light, Paris, 16–17 Mar. 1966
(AD-634723) CFSTI: HC $2.00/MF $0.50

A method is given for predicting the distances at which the thermal radiation from nuclear detonations will be hazardous to the unprotected human eye. This method relates calculated retinal exposure to experimentally determined eye effects data. Eye hazards as a function of distance are determined for the unprotected human eye exposed to sea-level, air-burst detonation from 0.01 to 10 kt yield. The pupil diameter of the human eye is taken to be 2.5 mm and 6.0 mm respectively, for day and night conditions and the effective focal length of the eye is taken to be 17 mm. Nuclear detonation characteristics and scaling factors are taken from Glasstone's "The Effects of Nuclear Weapons." The results indicate that the eye hazard is the limiting factor in determining the distance of nearest approach to a nuclear detonation unless eye protection is provided. Eye hazards as a function of distance are also determined for the human eye protected from daytime detonations by a 2% transmission fixed filter. The results indicate that use of such a filter will provide eye protection at distances where other hazards become limiting factors. Author (TAB)

N66-34590# Army Natick Labs., Mass.
DEVELOPMENT OF NUTRITIONALLY DEFINED METABOLIC DIETS FOR AEROSPACE TRAVEL Final Report, Jan.–Dec. 1964
H. Hollender, H. A. Dymsza, and M. Klicka Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 16 p refs
(AMRL-TR-65-218; AD-635499) CFSTI: HC $1.50/MF $0.50

Data compiled during the development of a nutrient defined diet in various flavors and physical forms are presented. The formulation of a liquid form of this diet including the nutrient composition, emulsion stability, antifoaming agents, flavor selection, and the techniques of packaging are discussed. An assessment of the organoleptic quality of the liquid nutrient defined diet by taste panel experts revealed a rating of 6.0 or above for the vanilla and chocolate flavors using a 9 point hedonic scale. Although slightly acceptable to taste panelists, this diet needs major flavor improvement if it is to be considered for use as the sole nutrient source for humans for prolonged periods of time. At the present time, this nutrient defined formulation is considered the best available liquid diet for sole support of humans in aerospace systems. Author (TAB)

N66-34613# Army Chemical Center, Edgewood, Md.
REGULATION OF METABOLISM, IN VIVO
Bertram Sacktor and E. Wormser-Shavit Jun. 1966 11 p refs
(AD-634636) CFSTI: HC $4.00/MF $0.75

The concentrations of 35 critical metabolites, including glycogen, trehalose, components of the glycolytic pathway and citric acid cycle, amino acids, phosphates, and adenine nucleotides in flight muscle of the flowfly, phormia, were measured concurrently after periods of flight ranging from 5 sec to 1 hr. Coincident changes in metabolites concomitant with the 100-fold increase in glycolytic flux attained on initiation of flight provided an unique system to determine the steps that control glycolysis in vivo, in the transition from a tissue at rest to one performing strenuous work. Three sites of regulation: the phosphorylation of fructose-6-phosphate; the cleavage of trehalose; and the phosphorolysis of glycogen were established in this system in vivo. Additional controls at the oxidations of alphaglycerophosphate and of proline are suggested.
Author (TAB)

N66-34824# Ash Stevens, Inc., Detroit, Mich.
HIGH-YIELD REACTIONS TO INTRODUCE ALDEHYDE GROUPS INTO PYRIDINE DERIVATIVES Final Comprehensive Report
F. A. Daniher and A. B. Ash May 1966 61 p
(Contract DA-18-035-AMC-374(A))
(AD-635119) CFSTI: HC $1.50/MF $0.75

The mechanism of the deoxygenation of 5-ethyl-2-picoline N-oxide with benzyl sulfonyl chloride was elucidated. Two new methods for the deoxygenation of pyridine N-oxides were discovered. The sulfonyl chloride rearrangement of 2-picolin N-oxides was extended to include sulfonic acid anhydrides and sulfonyl bromides. The selective reduction of cyanopyridines to pyridinecarboxaldehydes with Raney nickel was investigated. The conversion of 2-pyridinemethanols to their oximes via the 2-sulfonate esters was demonstrated. The oxidation of 2-pyridine methanols to the corresponding aldehydes with manganese dioxide gave moderate yields. Oxidation of 2-pyridine methanols with T-butyl hypochloride gave the aldehyde in yields of 45 to 57%. 2-pyridin aldoxime methochloride was prepared from 2-pyridine methanol by a new sequence involving (1) quaternization with methyl iodide, (2) conversion to the 2-chloromethyl analog with thionyl chloride and (3) reaction with hydroxylamine; the overall yield was 56%. The conversion of 4-picoline N-oxide to 4-pyridine aldoxime via anil formation, acid hydrolysis, and oxime formation was successful.
Author (TAB)

N66-34836*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
A STATISTICAL ANALYSIS OF ELECTROPHYSIOLOGICAL DATA FROM AUDITORY NERVE FIBERS IN CAT Technical Report No. 451
Peter R. Gray 21 Jun. 1966 102 p refs
(Grant NsG-496; Contract DA-36-039-AMC-03200(E); Grants NSF GK-835; NIH-2-P01-MH-04737-08)
(NASA-CR-77274) CFSTI: HC $4.00/MF $0.75 CSCL 06C

Electrophysiological data from single auditory nerve fibers have been analyzed with the objective of developing a random-process model for the firing patterns of these fibers. This study differs from earlier attempts at modeling these data in that new data-processing methods have been employed in order to more directly test and refine assumptions relating to models. In addition to calculating conventional post stimulus time (PST) and interval histograms, various conditional probabilities associated with the firing patterns have been estimated. These analyses suggest that a fiber recovers from the refractory effects that follow a firing within 20 msec after the firing. The effect of the stimulus on a fiber that has apparently recovered can be studied by estimating the conditional probability of a spike in a particular interval of time, given some minimum time since the last firing. Analysis of these recovered probabilities allows a more direct comparison of some aspects of model and data than is possible with other calculations such as the PST histogram. Results from these and other conditional probability analyses are presented with particular emphasis on data obtained with short acoustic clicks as stimuli.
Author

N66-34883*# Oklahoma City Univ., Okla.
[INTERDISCIPLINARY STUDIES OF THE EFFECTS OF THE SPACE ENVIRONMENT ON BIOLOGICAL SYSTEMS] Semiannual Status Report
30 Apr. 1966 54 p refs
(Grant NsG-300-63)
(NASA-CR-77216) CFSTI: HC $3.00/MF $0.50 CSCL 06F

Most parameters employed indicated that rats tend to adapt after 12 weeks of constant exposure to an environment composed essentially of oxygen at 5 psia. It has been shown that the rate of conversion of C^{14}-acetate to $C^{14}O_2$ was slowed but that the steady state rate of total CO_2 expiration was not altered in the experimental animals which were exposed to the high oxygen-low pressure environment for 4 weeks. The metabolic implications of these data are discussed. The amount of ascorbic acid found in the adrenal glands was considerably reduced in animals exposed for 4 weeks to the test environment, and the eyes of animals exposed for 4 weeks to the high oxygen-low pressure environment contained 33% less lipid than the control animals.
Author

N66-34884*# Maryland Univ., College Park. Dept. of Botany.
A STUDY OF PHYCOPHYSIOLOGY IN CONTROLLED ENVIRONMENTS Twelfth Semiannual Status Report, 1 Oct. 1965-31 Mar. 1966
Robert W. Krauss 1 Apr. 1966 40 p refs *Itr* Tech. Rept.-1012
(Grant NsG-70-60)
(NASA-CR-77217) CFSTI: HC $2.00/MF $0.50 CSCL 06P

The physiology is examined of unicellular algae whose culture characteristics make it possible for them to serve in biological regeneration. During studies on the growth of algae at varying cell concentrations and light intensities, the responses of *Chlorella vannielii* cultures indicated the optimum yield for cell populations is approximately 0.9 gram dry weight/liter/day. Similar studies with the high temperature *Chlorella sorokiniana* show a shift in the yield curve at the high light intensities, which indicates that this species may perform exceptionally at greater light intensities and population densities. Experiments showing the effects of gas mixtures other than those normally encountered on earth on algal growth were performed. A complete elimination of both nitrogen and oxygen by substitution of helium for both of them, and a substitution of nitrogen for oxygen proved to be beneficial. Studies on the adaption and mutation and organic composition of *Chlorella* species are also briefly discussed, and papers on primary cellular aging and sterols of *Chlorella* are included.
A.G.O.

N66-34887*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
CONTINUATION OF STUDIES IN STATISTICAL DECISION THEORY IN LARGE SCALE BIOLOGICAL EXPERIMENTS Final Report, 1 May 1965-31 Jul. 1966
Dian R. Hitchcock and Gordon B. Thomas 31 Jul. 1966 65 p refs
(Contract NASw-871)
(NASA-CR-77234; SLS-6306R) CFSTI: HC $3.00/MF $0.75 CSCL 06C

The empirical implications of the viewpoint that living organisms are characterized by some feature equivalent to or implied by the negative entropy assumption is examined. The biological significance of atmospheric compositions and surface atmosphere reactions were studied, with emphasis placed on demonstrating the validity of a characterization of life in terms of its ability to establish and maintain a free energy gradient between itself and some portion of its environment. The Martian analysis atmosphere is analyzed, and the extrapolation of these results to a life detection experiment is considered. The distribution of n-alkanes in materials of biotic, abiotic, and unknown origin was observed to determine whether the order in these distributions could be computed from a digitized gas chromatogram. A class of processes was selected which are described in terms of the information which some subset of the ordinates of the observed chromatogram conveys about the whole chromatogram. Comparative data on the various materials are presented. M.G.J.

N66-34669*# Maryland Univ., College Park.
MICROWAVE MEASUREMENT OF PROTEIN HYDRATION AND OF END GROUP CHARGE ACTIVITY Progress Report, 1 Feb.–31 Jul. 1966
[1966] 25 p refs
(Grant NGR-21-002-040)
(NASA-CR-77238) CFSTI: HC $1.00/MF $0.50 CSCL 06

A research program investigating the dielectric absorption of microwave frequencies for specific neuroproteins is in progress. It is expected that this investigation will yield information on the water of hydration of the macromolecule and on specific and group anisotropic activity which will be of value in both structural and physiological interpretation. The microwave cavity for this dielectric measurement has now been completed and is illustrated. Features of the instrument are discussed. The design and construction of a controlled-environment chamber is reported, with graphic information showing the time-voltage relationships which plateau the chamber to a variety of final temperatures. Author

N66-34711# New England Deaconess Hospital, Boston, Mass. Cancer Research Inst.
NEW ENGLAND DEACONESS HOSPITAL SUMMARY PROGRESS REPORT, 1 APRIL 1960 THROUGH 30 APRIL 1965, PART III
[1965] 117 p refs
(Contract AT(30-1)-901)
(NYO-901-37) CFSTI: HC $4.00/MF $0.75

Brief summaries are presented of results of radiobiological studies and studies using radioisotopes as tracers in various physiological studies conducted over a 15-year period. A list is included of 403 publications during the period. Separate abstracts were prepared for 7 sections of this report. NSA

N66-34744# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SNPO AND SNAP BIOLOGICAL STUDIES Summary Technical Report
R. C. Thompson 3 Jan. 1966 17 p
(Contract AT(45-1)-1830)
(BNWL-182) CFSTI: HC $1.00/MF $0.50

Preliminary results are reported from a series of studies related to the biological effects of inhaled or ingested ^{238}Pu SNAP fuel particles. Dogs were exposed to aerosols of ^{59}Fe-labeled ceramic microspheres ranging in diameter from 6.2 to 20μ. Whole-body scanning was used to follow the distribution of inhaled or swallowed particles over a 2 mo. period. Simulated reactor fuel particles, about 1 mm in diameter and consisting of depleted U in a graphite matrix spiked with ^{89}Sr, and ^{90}Sr–^{90}Y, were used to study the effects of dose rates of 13,000 rad/hr at the surface and 4000 rad/hr at a tissue depth of 50 mg/cm^2 on the skin and gastric mucosa of miniature swine and the radiation dose from ingested particles in rats. A single swine was fed massive doses (approximately 1 C) of ^{238}Pu SNAP fuel particles and the α activity of blood, feces, and urine was followed for 14 days before the animal was sacrificed and various tissues were analyzed for ^{238}Pu content. A simulant for gastric juice was prepared for use in studies of the solubility of SNAP fuel element materials. NSA

N66-34752# Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany).
DETERMINATION OF THORIUM IN URINE [DIE BESTIMMUNG DES THORIUMS IN HARN]
J. Sommer Dec. 1965 23 p refs In GERMAN; ENGLISH summary
(SZS-12(1965))

A fluorometric and a colorimetric method for the determination of thorium are compared. Procedures for both methods are given. The thorium is separated from the urine by an alkaline earth phosphate precipitation and from inorganic materials by a lanthanum fluoride precipitation and a TTA-extraction. After addition of 5, 10, 50, and 100/μg Th yields were 86 and 87%, standard deviations ±7 and ±8%, and detection limits 2.3 and 2.9/μg for the fluorometric and the colorimetric method, respectively. Author (NSA)

N66-34788# Army Foreign Science and Technology Center, Washington, D. C.
CONCERNING SOME ELEMENTS OF CHLORELLA PROTEIN STRUCTURE
N. N. Mel'Teva, L. I. Polotnova, N. I. Tikhomirova, and A. A. Freyman Jun. 1966 9 p refs Transl. into ENGLISH from Izv. VUZov—Pishchevaya Tekhnol. (USSR), no. 6, 1965
(FSTC-HT-23-109-66; AD-634320) CFSTI: HC $1.00/MF $0.50

Treatment of lyophil-dried specimens of chlorella with dichlormethane freed them of the impurities which cause swelling in water solutions. The protein separated from chlorella, regardless of the form of solvent, contains the same *N*-terminated groups (glutamic acid, methionine and a small quatity of aspartic acid) and *C*-terminated groups—(tyrosine and arginine). In chlorella, the amount of proteins containing lysine with free amino group is less than the amount of lysine determined after complete hydrolysis of the protein. It is assumed that a portion of the lysine contained in the protein of the chlorella is assimilable. Author (TAB)

N66-34775# Army Natick Labs., Mass. Clothing and Materials Div.
THE MET AND THE CLO, PART I: RESTATEMENT OF THE ORIGINAL DEFINITIONS Technical Report, Nov. 1962–Nov. 1965
David L. Fiske May 1966 16 p refs *Its* Tech. Rept.-66-21-CM
(MR&E-66-2; AD-634271) CFSTI: HC $1.00/MF $0.50

The definitions of the met (50 Kcal/sq m, hr = 18.5 Btu/sq ft hr) and the clo (5.55 Kcal/sq. m hr deg C = 1.14 Btu/sq. ft hr deg F), as derived from the original paper (1941) by the three physiologists Gagge, Burton, and Bazett, are discussed in terms familiar to heat transfer engineers. The

number of the clo required, n, is stated as a function of the temperature, t, (in deg F), by the equation: $n = 0.0814(92-T) - 0.792$. This gives a value of n of 1.0 at t = 70° F.

Author (TAB)

N66-34778# Naval School of Aviation Medicine, Pensacola, Fla.

MEASUREMENT OF LEFT CIRCUMFLEX CORONARY FLOW, CARDIAC OUTPUT, AND CENTRAL AORTIC PRESSURE IN THE UNMEDICATED GREYHOUND DOG

Leroy S. Wirthlin and E. Peter Beck 2 May 1966 20 p refs (NAMI-962; AD-634922) CFSTI: HC $1.00/MF $0.50

To study coronary flow dynamics under basal and changing environmental conditions, it was necessary to develop a standard animal preparation in which left circumflex coronary flow, phasic systemic cardiac output, and central aortic pressure could be measured in the awake, unmedicated state. A technique involving the surgical implantation or electromagnetic flow probes and chronic sampling catheters was successfully applied to nine greyhound dogs. Left circumflex coronary artery (LCCA) flow data, cardiac output, and central aortic blood pressure determinations are presented. In addition, coronary sinus blood determinations for five of the animals (together with the flow data) are included. LCCA flow ranged from 57 to 130 ml/min (35 to 57 ml/100 gm left ventricle/min.). Twenty to forty-seven per cent of flow occurred during left ventricular systole. Oxygen usage ranged from 7.6 to 11.9 ml/min (4.8 to 9.8 ml/100 gm left ventricle/min). The LCCA flow patterns and the range of flow values agree closely with those reported previously by Gregg. It was felt that our measurements were made in the resting but not necessarily basal state. Author (TAB)

N66-34795*# Stanford Univ., Calif. Instrumentation Research Lab.

CYTOCHEMICAL STUDIES OF PLANETARY MICROORGANISMS—EXPLORATIONS IN EXOBIOLOGY Status Report, Sep. 1, 1965–Apr. 1, 1966

Joshua Lederberg and Elliott C. Lavinthal [1966] 35 p refs (Grant NsG-81-60)

(NASA-CR-77175; IRL-1050) CFSTI: HC $2.00/MF $0.50 CSCL 06F

Resumes are presented in the following research areas related to planetary microorganisms: multivator, fluorometry, gas chromatography and optical resolution, mass spectrometry, computer managed instrumentation, and ultraviolet microspectrometry. Evaluation of a neon light source for phosphotase is reviewed under the multivator section, and fluorometry projects deal with reagents for fluorometric assays of hydrolytic enzymes and nanosecond flash fluorometry (phosphorometry). Papers prepared on the analysis of natural products by mass spectrometry are listed; and reviews are included of the mass spectral microanalysis of solids, mass spectrometer data presentation, and computer manipulation of chemical hypotheses.

M.W.R.

N66-34819# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

CHEMICAL REACTIONS ON CLEAN SURFACES, USING MODULATED ATOMIC BEAM TECHNIQUES Annual Technical Summary Report, Apr. 1, 1965–Mar. 31, 1966

Howard Saltsburg and Joe N. Smith, Jr. 26 Apr. 1966 21 p refs

(Contract AF 49(638)-1559)

(GA-7108; AFOSR-66-1360; AD-635153) CFSTI: HC $1.00/MF $0.50

The design of a molecular beam experiment to study chemical reactions on clean metal surfaces is described. The motivation for the particular approach to the attainment of clean surfaces and surfaces with a controlled concentration of surface adsorbate is discussed. Finally, the results of the first 12 months effort on this program are summarized, and certain experimental problem areas are discussed.

Author (TAB)

N66-34869# Naval Radiological Defense Lab., San Francisco, Calif.

SODIUM TRANSPORT IN ULVA

Joseph T. Cummins, John A. Strand, and Burton E. Vaughan 6 May 1966 19 p refs

(USNRDL-TR-1016; AD-634835) CFSTI: HC $1.00/MF $0.50

The transport of sodium through the marine algae Ulva lobata and Ulva expansa has been studied by a tracer analytical method. Sodium was transported across Ulva at a rate of 0.15%/min in the dark; this rate was slowed by ouabain and increased by formaldehyde. Dinitrophenol DCMU, and ammonium ion had no effect on the dark rate. Light caused a transient, rapid light extrusion of sodium from the algae equal to approximately twice the amount of sodium expected during a two minute dark period. All the inhibitors adversely affected the efflux of sodium due to light. Comparison of the ability of choline and sucrose to elute sodium from Ulva showed that a high portion of the sodium can be released, but only by a process similar to ion exchange. Author (TAB)

N66-34874# Naval School of Aviation Medicine, Pensacola, Fla.

SOME SECONDARY DETERMINERS OF PSYCHOLOGICAL STRESS

Patrick M. Curran and Robert J. Wherry, Jr. May 1966 21 p refs

(NAMI-963; AD-635205) CFSTI: HC $3.00/MF $0.50

The study employed a four-choice, color discrimination task and electric shock in a simulated aircraft flight over hostile country to investigate certain secondary determiners of anticipatory physical threat stress which are presumed to be components of the perceived proximity of the unpleasant event. The findings suggest that the three secondary determiners of anticipatory physical threat stress investigated (perceived time since the situation started, perceived time until the event occurs if it occurs, and time elapsed since the initial warning of the possible event occurrence) are significant components of the perceived proximity of the unpleasant event, and that they interact in a complex manner. Further research is suggested to determine the nature of the interaction of these components over time. A measure was devised which is considered to reflect differences in individual susceptibility to anticipatory physical threat stress.

Author (TAB)

N66-34876# School of Aerospace Medicine, Brooks AFB, Tex.

PAROTID FLUID CORTICOSTEROID RESPONSE IN NORMAL SUBJECTS DURING SINGLE-DOSE DEXAMETHASONE SUPPRESSION TESTS Final Report, Oct. 1965

Ira L. Shannon, Steven C. Beering, and Robert L. Janson Apr. 1966 11 p refs

(SAM-TR-66-39; AD-635110) CFSTI: HC $1.00/MF $0.50

Serum and parotid 17-OHCS measurements were carried out on 6 healthy young adult males during a control week and during a second week in which single-dose dexamethasone

tests were performed. There were no significant differences in steroid means for either fluid during the control week. At 8 hours after dexamethasone dosage the serum steroid mean decreased by 84.6% and the decrease in parotid fluid concentration was 76.6%. The highly significant suppression of the level of 17-OHCS in serum was proportionately reflected in the steroid response in parotid fluid. These fluid might well be substituted for serum determinations and reinforce previous observations from our laboratory in this regard.
Author (TAB)

N66-34883# Naval Medical Research Inst., Bethesda, Md. Naval Medical School.
POLAR MANUAL: ARCTIC AND ANTARCTIC LIVING CONDITIONS, PERSONNEL SELECTION, HYGIENE AND SANITATION, CLOTHING, NUTRITION, SUPPLIES, AND EQUIPMENT, VISUAL DISABILITIES AND COLD INJURIES, FIRST AID, SAFETY, AND SURVIVAL
Earland E. Hedblom 1965 172 p refs 4th edition
(AD-634266) CFSTI: HC $5.00/MF $1.00

Living conditions and the selection of personnel are reviewed, and discussions are given on hygiene and sanitation, clothing, nutrition and cooking, injuries and first aid, safety and survival rules and regulations, and transporation and logistics.
N.E.N.

N66-34907# Naval Oceanographic Office, Washington, D. C.
COMPREHENSIVE INVESTIGATIONS OF LUMINESCENCE IN THE SEA DURING SCIENTIFIC EXPEDITIONS [KOMPLEKSNYYE ISSLEDOVANIYA SVECHENIYA MORYA V NAUCHNOY EKSPEDITSII]
N. I. Tarasov and I. I. Gitel'zon Jul. 1966 9 p refs Transl. into ENGLISH from Bjul. Okeanograficheskoy Komis. AN SSSR (Moscow), no. 8, 1961 p 75–80
(TRANS-255; AD-635461) CFSTI: HC $1.50/MF $0.50

The level and scope of investigation of marine luminescence in the Soviet Union and the United States is compared. The great interest of American oceanographers in the phenomenon and their achievements are underscored. In order to elucidate the complex nature of bioluminescence, the authors urge to intensify investigations and construct charts of the distribution of luminescent organisms in vertical and horizontal directions, of intensity of bioluminescence, its variations in various taxonomic groups at various depth levels, and hydrological seasons, etc.
Author (TAB)

N66-34943# Army Aeromedical Research Unit, Fort Rucker, Ala.
COMMENT ON CORRELATION COEFFICIENT USE
R. A. Avner Jul. 1966 8 p refs
(USAARU-67-1; AD-635375) CFSTI: HC $1.50/MF $0.50

In computing the Pearson *r*, observations are identified on a nominal scale. The values assigned these observations are measured on a ratio or interval scale. Confusion of these two facts has led to the mistaken assumption that the Pearson *r* can measure degree of association between nominally measured variables.
Author (TAB)

N66-34958# Bio-Dynamics, Inc., Cambridge, Mass.
REVIEW OF COMBINED TRAUMA: RESEARCH, CLINICAL MANAGEMENT AND PLANNING Final Report
Dean W. Williams Jan. 1966 174 p refs
(Contract OCD-OS-63-141)
(AD-632595) CFSTI: HC $5.00/MF $1.00

The review covers the topic of combined trauma–radiation injury plus burns, physical injury, and/or infection. Since this class of casualty is almost exclusively the product of nuclear weapons effects, the emphasis of the review is on principles of clinical management. Major sections of the review are: (1) A casualty model, generated to assess the significance of combined trauma relative to other forms of injury. (2) A review of clinical management principles for care of combined trauma patients. (3) Clinical guides to the care of radiation, burn, and infection casualties. (4) A review of the recent combined trauma research, and (5) A summary of planning measures designed to assist in preparedness for disaster medical care. An extensive bibliography is also included.
Author (TAB)

N66-34999# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
LECTURES ON ELECTRON MICROSCOPY. IV: SPECIMEN PREPARATION—THIN SECTIONING TECHNIQUES
R. W. Horne (Agr. Res. Council, Cambridge, England) 26 Jun. 1965 21 p Lectures held 23–28 Jun. 1965
(ISS-65/26) CFSTI: HC $1.00/MF $0.50

This report deals with the methods for fixing, embedding and sectioning of tissues for the electron microscope.
Author

N66-35000# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
LECTURES ON ELECTRON MICROSCOPY. III: SPECIMEN PREPARATION TECHNIQUES—BASIC PRINCIPLES
R. W. Horne (Agr. Res. Council, Cambridge, England) 25 Jun. 1965 30 p Lectures held 23–28 Jun. 1965
(ISS-65/25) CFSTI: HC $2.00/MF $0.50

This report will form the first of three lectures on the basic principles for the preparation of specimens for electron microscopy. Some of the most general techniques are discussed: methods of supporting the object on a type of film; shadow casting; positive staining; thin sections and replicas.
Author

N66-35002# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
LECTURES ON ELECTRON MICROSCOPY. VI: THE STRUCTURE OF VIRUSES
R. W. Horne (Agr. Res. Council, Cambridge, England) 28 Jun. 1965 47 p refs Lectures held 23–28 Jun. 1965
(ISS-65-28) CFSTI: HC $2.00/MF $0.50

This lecture, the last of six lectures on electron microscopy, describes some of the recent findings on the structure of animal, plant, and bacteria viruses, in particular the details observed in the electron microscope.
Author

N66-35012*# California Univ., Berkeley. Dept. of Nutritional Sciences.
STUDY OF ENVIRONMENTAL EFFECTS ON CELLULAR AUTOXIDATION Final Report, Mar. 1, 1965–Feb. 29, 1966
D. B. Menzel [1966] 82 p refs
(Grant NGR-05-003-090)
(NASA-CR-77392) CFSTI: HC $3.00/MF $0.75 CSCL 06T

Three areas were investigated to test the hypothesis that oxygen toxicity is a result of increased lipid peroxidation: in vivo peroxidation effects on cell membranes were measured using rats exposed to 100% oxygen at 260, 400, 600, and 760 mm Hg; an in vitro method of studying membrane oxidation was developed using isolated rat kidney lysosomes; and a new reaction involving the products of lipid oxidation, malonaldehyde, and other thiobarbituric acid reactive substances was discovered and studied. Rats exposed to 100%

oxygen grew less than those exposed to air; they showed changes in their lysosomal enzymes in lung and brain tissue; and liver lysosomes showed latent changes in the lysomal membrane indicating that very subtle effects from oxygen exposure may hitherto have gone unnoticed. The in vitro method was developed using kidney lysosomes, and the effects of salts, pH, and osmolarity of the medium were studied. It was demonstrated that aldehydes produced during lipid oxidation react with proteins and amino acids. Polymerization of ribonuclease results from reaction with aldehydes and the polymers are less enzymatically active than the native enzyme. It was concluded that the validity of the original hypothesis was demonstrated. L.E.W.

N66-35021*# California Univ., Los Angeles. Brain Research Inst.

NEUROPHYSIOLOGICAL AND BEHAVIORAL STUDIES OF CHIMPANZEES Semiannual Report, Jan. 1–Jun. 30, 1966

J. D. French and W. R. Adey 1 Aug. 1966 32 p refs

(Grant NsG-502)

(NASA-CR-77386) CFSTI: HC $2.00/MF $0.50 CSCL 05J

Techniques and instrumentation for application to neurophysiological and behavioral studies of chimpanzees are discussed in detail including basic patterns and their application to space flight. The acquisition and training of chimpanzees is briefly described. Data analysis, including computer analysis of EEG data and combining mathematical analysis of EEG data and impedance data to study learning and behavior in the chimpanzee, is discussed. Developments in bioinstrumentation are outlined, e.g., packaging and miniaturization of a multichannel biotelemetry system and development of DC blood flow transducing devices. Development of bioinstrumentation and feasibility studies that will form the basis of the experiments for Apollo applications are summarized, including details on environment chambers, physiological instrumentation, waste management, and data analysis methods. Results of computer analysis of performance data in the chimpanzee are also presented in tabular form. L.E.W.

N66-35028# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

LECTURES ON ELECTRON MICROSCOPY. V: THE APPLICATION OF NEGATIVE STAINING TO THE STUDY OF BIOLOGICAL STRUCTURE IN THE ELECTRON MICROSCOPE

R. W. Horne (Inst. of Animal Physiol., Cambridge, England) 26 Jun. 1965 44 p refs

(ISS-65/27) CFSTI: HC $2.00/MF $0.50

This report deals with the techniques of negative staining as applied to electron microscopy. Various investigations on the structure of bacteria, cellular fractions, single molecules and groups of them are described. Author

N66-35056# Instituto Nacional de Technologia, Rio de Janeiro (Brazil).

THE EFFECT OF FENTON'S REAGENT ON TRYPSIN AND RIBONUCLEASE Final Report, 1 Jun. 1965–31 May 1966

J. C. Perrone Jun. 1966 38 p refs

(Grant DA-ARO-49-092-65-G82)

(Rept.-2; AD-635207) CFSTI: HC $2.00/MF $0.50

The inactivation of trypsin by Fenton's reagent is very fast during the first few minutes of reaction. In the first three minutes of reaction about 50% of the activity is lost. However, the inactivation after this initial reaction period is much slower. Fractionation of the reaction mixture shows the presence of two main components: a fast fraction with little activity and a slower and more active fraction. Several authors have published experiments showing that partially damaged molecules are formed during the irradiation of proteins. It was possible to demonstrate that this is also true for trypsin treated with Fenton's reagent. Furthermore, trypsin after suffering this double treatment showed marked changes in its enzymatic characteristics. Cu^{++} was found to have a marked influence on the inactivation of ribonuclease by Fenton's reagent. TAB

N66-35061# Armed Forces Radiobiology Research Inst., Bethesda, Md.

ESTIMATION OF PARAMETERS IN MULTIVARIATE EXPERIMENTAL DESIGN AND A HYPOTHETICAL APPLICATION TO ESTIMATING FRACTIONAL DOSE RECOVERY EFFECTS

J. A. Greenwood Feb. 1966 26 p

(AFRRI-TN66-2; AD-635167) CFSTI: HC $1.00/MF $0.50

A statistical technique is explained, derived and illustrated. It is believed that a study of the values of the terms of the assumed mathematical model (or the graphs therefrom) would be of great informational help to the scientist in interpreting his results. Analysis of variance, components of variance analysis, and the estimation technique described herein applied to a properly designed experiment will go far toward extracting all the relevant information from a sample. Estimation formulas for the terms of the assumed mathematical model are derived for two of the most used statistical experimental designs, the factorial and the orthogonal squares. The method is illustrated on a three-variable, hypothetical dose recovery experiment. It is pointed out that the method gives one a handle on measuring quantitatively the separate and joint contributions to the observed effect of variables otherwise hopelessly correlated and overlapping. Author (TAB)

N66-35084# School of Aerospace Medicine, Brooks AFB, Tex.

ISOLATION OF MIMA AND HERELLEA FROM AN EXPERIMENTAL SPACE-FLIGHT DIET Final Report, 25 Jan.–15 Mar. 1965

Joseph T. Cordaro, Roberta J. Ball, and Jerome P. Schmidt Apr. 1966 9 p refs

(SAM-TR-66-38; AD-635377) CFSTI: HC $1.00/MF $0.50

Mima, Herellea, and other gram-negative, nonfermenting bacteria were isolated from samples of an experimental space-flight diet. Identification of these organisms was facilitated by the use of Sellers's differential agar, although the source of these organisms was not determined, it is possible that the utensils used in preparing the diet were contaminated by the food handler. Mima and Herellea could not be recovered from the feces of subjects subsisting on this diet. Author (TAB)

N66-35087# Armed Forces Radiobiology Research Inst., Bethesda, Md.

ERYTHROCYTE STEM CELL KINETICS IN THE POST-RADIATION RAT

S. J. Baum May 1966 23 p refs

(AFRRI-SR66-4; AD-635086) CFSTI: HC $1.00/MF $0.50

In rats exposed to 300 R of 250 KVP X-rays, erythropoiesis as measured by ^{59}Fe uptake diminished greatly for 48 hours followed by a rapid recovery approaching near normal values approximately 6 days after radiation. It has been postulated that the rate of recovery was primarily due to

accelerated release of noninjured stem cells. The present experiment was designed to test this hypothesis. The polycythemic rat preparation was used since it permits the experimenter to control the release of erythrocyte stem cells. In polycythemic rats observed for 17 days postradiation (300 R of 250 KVP X-rays), stem cell release diminished to 8% of the control values during the first 24 hours. This was followed by a rapid recovery from the 2nd to the 5th day. A second decrease was noted from the 6th to the 9th day and a third depression from the 9th to the 12th day. Thereafter, the oscillations diminished indicating a possible return toward the preradiation normal state. An attempt was made to correlate these findings with a kinetic model of erythropoiesis. It was suggested that the initial depression in stem cell release might be due to cellular destruction and inhibitions of cellular release mechanisms. The oscillations of the recovery curve were ascribed to possible rate differences in cellular movements from one precursor compartment to the subsequent one, and to competitive simulations for progenitor cells from related cellular systems of the hematopoietic system. Author (TAB)

N66-35088# School of Aerospace Medicine, Brooks AFB, Tex.

THE EFFECT OF A "TUBE-TYPE" DIET AND STRESS-INDUCING CONDITIONS ON TOOTH MOBILITY, MARCH 1964–OCTOBER 1965

Timothy J. O'Leary, Kenneth D. Rudd, Claude L. Nabers, and Arthur J. Stumpf, Jr. May 1966 13 p refs

(SAM-TR-66-43; AD-635113) CFSTI: HC $1.00/MF $0.50

Three studies were conducted to determine tooth mobility changes. The first two studies considered the effect of a tube-type diet, requiring no mastication, on tooth mobility. The third study evaluated the effect of the same diet, but stress-inducing conditions were added. In the first study, 4 of the 5 participants showed no change from pre-experimental levels for mean tooth mobility after 33 days. The 5th participant, after learning of a family emergency, showed a significant ($p < .01$) increase in mean mobility at the second experimental assessment (33d day). Five subjects subsisted on the tube-type diet for 34 days in a second study. There was no significant difference between the means of the pre-experimental and experimental measurements of the subjects. In a third study, 3 of the subjects displayed evidence of occlusal habits. All 7 subjects were exposed to stress-inducing conditions of confinement and rigid regulation for the first 30 days. There was a significant ($p < .01$) increase in the tooth mobility values for the subjects with occlusal habits. Author (TAB)

N66-35104# Melpar, Inc., Falls Church, Va.

ELECTRONIC SIMULATION OF THE DYNAMICS OF EVOLVING BIOLOGICAL SYSTEMS Final Technical Report

Keith E. Justice, Edward M. Connelly, and Judy M. Gervinski Wright-Patterson AFB, Ohio. AF Avionics Lab., May 1966 127 p refs

(Contract AF 33(615)-2456)

(AFAL-TR-66-151; AD-635391) CFSTI: HC $4.00/MF $1.00

A bionic investigation and modeling of organic evolution is described. The project was undertaken to provide a deeper understanding of the adaptive processes involved in organic evolution. Of particular interest was a comparison of self-organizing processes in evolutionary systems and analogous processes in trainable logical networks. The biological prototype for the model is the feral house mouse (Mus Musculus) as it exists in semi-isolated populations in the southwestern United States. Special emphasis is given to a balanced lethal genetic system known to exist in the species. Using Monte Carlo techniques, the model simulates, for each individual, such events as the probability of survival, migration, mating, reproduction, mutation, genetic segregation, and natural selection. Implementation of the model on a digital computer is described. Results of experiments performed with the model show that the model behaves in a manner highly analogous to both the biological prototype and to certain aspects of trainable logical networks. Implications and theoretical investigations of the work for future developments in machine intelligence are discussed. Author (TAB)

N66-35112# School of Aerospace Medicine, Brooks AFB, Tex.

BIOCHEMICAL STUDIES ON ACUTE HYDRAZINE TOXICITY IN MICE Final Report, 1 Jul. 1964–30 Jun. 1965

Eugene Roberts and Daisy G. Simonsen Apr. 1966 22 p refs

(Contract AF 41(609)-2614)

(SAM-TR-66-33; AD-635111) CFSTI: HC $1.00/MF $0.50

Two-dimensional paper chromatographic methods were employed to study the changes produced in amino acid distribution in tissues of normal mice, mice treated with hydrazine, and mice pretreated with protective amino acids before injection with hydrazine. The data suggest that the symptoms of acute hydrazine toxicity do not coincide with any major effects on carbohydrate or amino acid metabolism of brain but do occur at a time when significant changes are noted in amino acid distribution in liver. Particular attention was paid to the area of arginine metabolism. Although arginine injection, itself, produced only an increase in ornithine content in the liver, when arginine was followed in 30 minutes by the administration of hydrazine there were marked increases in both ornithine and citrulline levels. In no instance was there any evidence of the accumulation of argininosuccinic acid. The data were tentatively interpreted to indicate that under ordinary conditions the rate-limiting step in the ornithine cycle of liver may be the carbamylation of ornithine, but that in hydrazine-poisoned animals the condensation reaction of citrulline with aspartic acid to give argininosuccinic acid might become rate-limiting. The significance of this finding is under further investigation, as well as the possibility that changes observed in other ninhydrinreactive constituents in the livers of hydrazine-poisoned animals might be secondary to the inhibition of the above reaction. Lipid analyses of livers of control and hydrazine-treated mice showed that no significant abnormalities occurred in the distributions of the individual constituents as a result of hydrazine injection at a time that marked changes in amino acid content were noted. Author (TAB)

N66-35120# Keio Univ., Tokyo (Japan). School of Medicine.

AUTOMATIC RECORDING OF PO_2, PCO_2, pH, Na AND K IN THE BLOOD AND THE BRAIN Final Report, 15 Mar. 1965–14 Mar. 1966

Toyozo Aizawa Jun. 1966 50 p refs

(Contract DA-92-557-FEC-37972)

(J-213-6; AD-634836) CFSTI: HC $2.00/MF $0.50

The effect of intravenous administration of concentrated Na and K solutions, and cardiorespiratory stimulants on cerebral circulation, metabolism and electrical activity were investigated in cats. (1) Effect of concentrated cation solutions: (a) Increased Na^+ in the extracellular fluids of the brain induced the electrical and metabolic activation and increase in cerebral blood flow. Electroencephalogram showed the seizure or low voltage fast activity. Cerebral blood flow increased, brain PO_2 and PCO_2 increased, pH decreased, Na^+ usually increased and when seizure started Na^+ changed to decrease. (b) Intravenous administration of concentrated K solution resulted in the cardiac dysfunction and consequently showed

a decrease in cerebral blood flow and metabolism, and electrical depression. After intracisternal administration of concentrated K solution, it appeared to show the metabolic and electrical activation. However, since there is a question about increase in concentration of K+ in the brain surface after intracisternal administration of K. Further investigation with more appropriate method is necessary for obtaining the direct action of K+ on the brain. (2) Effect of intravenous administration of cardiorespiratory stimulants of aminophylline, dimorpholamine, nikethamide, vitacampher and lobeline were investigated. Author (TAB)

N66-35124# Naval Air Development Center, Johnsville, Pa.
CATECHOL AMINE MEASUREMENTS ASSOCIATED WITH AUTONOMIC-LABYRINTHINE RESPONSES IN MAN EXPOSED TO POSITIVE (PLUS Gz) ACCELERATION Final Report
Elihu York, Kenneth R. Brown, and Alan Goldfien 13 Apr. 1966 18 p refs
(NADC-MR-6602; AD-634519) CFSTI: HC $1.00/MF $0.50

Five normal subjects and two labyrinthine-defective subjects were exposed to acceleration profiles consisting of linear, angular and combined (linear plus angular) stress. Catechol amines were measured in plasma and urine for both groups. A demonstrated rise in plasma nor-epinephrine occurred in two of the five normal subjects, both of whom developed motion sickness following a 'combined' acceleration stress. The normal group had measurable plasma epinephrine levels, under most circumstances, whereas the labyrinthine defective group had none. Although there is insufficient data to make a clear-cut separation between different types of acceleration stress in the two groups, and their associated biochemical responses; nevertheless, there is some evidence to suggest that the intact labyrinth is a factor influencing elaboration of catechol amines, which in turn may be implicated in the development of motion sickness.

Author (TAB)

N66-35138# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
REPORT OF THE TECHNICAL COMMITTEE ANTHROPOTECHNIK'S SESSION OF THE 25th OF NOVEMBER IN BERLIN [BERICHT UEBER DIE SITZUNG DES FACHAUSSCHUSSES ANTHROPOTECHNIK AM 25. NOVEMBER 1965 IN BERLIN]
31 Mar. 1966 38 p refs In GERMAN
(DLR-Mitt-66-03) CFSTI: HC $2.00/MF $0.50

Computer analyses of cortex impulse potentials showed that the human mind is not able to comprehend more than 100 information bids per second that reach the central nervous system through the eyes, ears, skin, smell, and taste sensors. Neurophysiological studies found that a spontaneous, frequency-dependent curbing of the neutron action potentials takes place in the cortex response to information impulses. It was concluded that the combined action of neutron potentials and frequency damping constitute an optimization of the sensory information processes. Insufficient optimization of the information processes and additional stress influences the alertness and efficiency of airplane pilots, especially during starting and landing procedures. Transl. by G.G.

N66-35142# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
SOME COMPARATIVE CONSIDERATIONS ON PUBLIC HEALTH ORGANISATION IN ITALY AND IN THE USA AND THE PROBLEM OF SANITARY SCIENTIFIC RESEARCH [CONSIDERAZIONI COMPARATIVE SULLA ORGANIZZAZIONE DELLA SANITA PUBBLICA IN ITALIA E NEGLI STATI UNITI IN CONNESSIONE CON IL PROBLEMA DELLA RICERCA SCIENTIFICA IN CAMPO SANITARIO]
G. Cortellessa 19 Dec. 1965 30 p refs In ITALIAN; ENGLISH summary
(ISS-65/47) CFSTI: HC $2.00/MF $0.50

This report deals with the United States Federal and State Agencies connected with the solution of problems of public health and sanitation. The action of such agencies shall be compared with that of the existing Italian Agencies. It shall be pointed out how these Federal and State Agencies have developed the scientific research in the field of public health and sanitation. Finally some specific problems shall be illustrated and conclusions drawn possibly valid for our country.

Author

N66-35164# Joint Publications Research Service, Washington, D. C.
ELECTROPHYSIOLOGICAL INVESTIGATIONS OF THE RETINA
A. L. Byzov 29 Aug. 1966 45 p Transl. into ENGLISH of the book "Elektrofiziologicheskiye Issledovaniya Setchatki" Moscow, "Nauka" Publishing House, 1966 p 5-8, 148-180, 195-196
(JPRS-37309; TT-66-33738) CFSTI: $2.00

Considered are questions associated with the functioning of the retina as a system for processing visual information, and the mechanisms of adaptation in the retina. The question of horizontal interaction at different levels of the retina and its possible role in the processing of visual signals was studied using the relatively simple *Limulus* eye. On the basis of studies of lateral (inhibitory) interaction and horizontal stimuli summation, it was concluded that the features observed in *Limulus* are also common to the retina of vertebrates. Results of experiments on the mechanisms of adaptation in the retina demonstrated the association of the sensitivity of the eye with the change in the electrical potential in the cells of the retina. Experimental observations indicated that these features may also apply to the retina of vertebrates.

S.C.W.

N66-35167*# Florida State Univ., Tallahassee. Inst. for Space Biosciences.
COPOLYMERIZATION OF THE LEUCHS ANHYDRIDES OF THE EIGHTEEN AMINO ACIDS COMMON TO PROTEIN
Tadao Hayakawa (Hokkaido Univ.), Charles Ray Windsor, and Sidney W. Fox (Miami Univ., Coral Gables) [1966] 23 p refs Submitted for Publication
(Grant NsG-173-62)
(NASA-CR-77448) CFSTI: HC $1.00/MF $0.50 CSCL 06A

The eighteen amino acids common to protein have been simultaneously condensed through the N-carboxy anhydrides. Nine of these monomers had first to be specially protected by groups which could subsequently be removed in a single operation. The polymer obtained resembles in quantitative composition an average natural protein. The nutritional and other significances of this type of polymer are discussed.

Author

N66-35168*# California Univ., Davis.
CHRONIC ACCELERATION STUDIES—PHYSIOLOGICAL RESPONSES TO ARTIFICIAL ALTERATIONS IN WEIGHT Progress Report
C. F. Kelly, A. H. Smith, E. L. Besch, R. R. Burton, and S. J. Sluka 1 Sep. 1966 25 p refs
(Grant NGR-05-004-008)
(NASA-CR-77449) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Results of investigations regarding the influence of chronic-acceleration on the energy metabolism of chickens and animals, as indicated by the maintenance feed requirement, are reported. Increases in feed intake and decreases in body size have been generally observed in a variety of animals under chronic-acceleration conditions. The greater feed requirements in these hyperdynamic environments are related to the increased work for the performance of various mechanical activities. From the data presented for the chickens, it appears that gravity is responsible for about 12% of their feed intake. If this proportion applies equally to the energy metabolism, a 2 kg homoiotherm would expend about 14 kcal/day. Other aspects of these studies are also discussed. L.S.

N66-35176*# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
MASS SPECTROMETRIC STUDIES OF PEPTIDES. III. AUTOMATED DETERMINATION OF AMINO ACID SEQUENCES
Martin Senn, R. Venkataraghavan, and F. W. Mc Lafferty [1966] 21 p refs Submitted for Publication
(Grants NGR-15-005-021; NIH GM-12755)
(NASA-CR-77446) CFSTI: HC $1.00/MF $0.50 CSCL 06A

By utilizing the exact mass of the N-terminal group, the amino acid sequence can be determined from a variety of oligopeptides whose components include 14 of the known amino acids. Most derivatives giving suitable sample vapor pressure and thermal stability can be used if a mass measuring accuracy of ±2 mmu is available. All histidine containing peptides run as the methyl esters appear to have a H atom replaced by CH_3. Automatic measurements of the spectral data plus computer calculation and interpretation of this data give promise that this method may find general use in protein research. Author

N66-35179*# California Univ., Los Angeles. Dept. of Surgery/Urology.
EXTRACTION AND BIOASSAY OF RENIN FROM KIDNEYS OF SODIUM-DEPLETED AND SODIUM-LOADED RATS
A. T. K. Cockett, R. S. Moore, M. Kazmin, and A. P. Roberts [1966] 14 p refs Presented at the Am. Urological Assoc. Meeting, Chicago, 29 May–2 Jun. 1966
(Grants NsG-237-62; PHS HE-09834-01)
(NASA-CR-77466) CFSTI: HC $1.00/MF $0.50 CSCL 06C

The concentrations of renin within rat kidney tissue were determined by extracting and bioassaying rat kidney tissue from sacrificed rats from experimental groups given a diet with increasing levels of sodium chloride after a diet deficient only in sodium chloride. In addition, renal tissue levels of renin after Angiotension II administration in the three groups of rats on the variable sodium diet, for 14 or 21 days, were also compared. Results indicate that rats placed on a low sodium diet for 14 or 21 days had higher concentrations of renin than the controls. Another group with a high sodium diet had lower tissue renin levels. The addition of the Angiotensin II for 21 days resulted in higher concentrations of tissue renin. It was suggested that Angiotensin probably has a preferential effect in the kidney producing further renal ischemia. L.S.

N66-35214*# Baylor Univ., Houston, Tex.
PHYSIOLOGIC OBSERVATIONS ON RACE CAR DRIVERS
Vincent P. Collins Washington, NASA, Sep. 1966 124 p
(Grant NsG-730)
(NASA-CR-570) CFSTI: HC $3.00/MF $1.00 CSCL 06S

Physiological and biochemical responses of race car drivers under conditions of nonsimulated stress were studied to determine the influence of environmental stimuli on individual performance. Field observations of four auto races and 29 subjects are reported. Tilt table tests obtained immediately after racing showed the following three patterns: a temporary fall in systolic pressure with a rise in diastolic pressure, a rise in both systolic and diastolic pressures, and a fall in both systolic and diastolic pressures. In-race recording of ECG showed a prompt and marked increase in heart rate coinciding sharply with the beginning and end of a race. Blood chemistry studies indicated that serum glucose may be of greatest important because of the possible influence of hypoglycemia on performance. Blood volume determinations on passive tilting tended to show a decrease due to an apparent decrease in plasma volume. On resuming recumbent position after tilt, blood volume of two subjects showed an increase. Further studies designed to seek a correlation between blood volume and hematocrit changes and the maintenance of diastolic pressure in passive tilting are suggested. S.C.W.

N66-35216*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE BIOLOGICAL SIGNIFICANCE OF THE SEARCH FOR EXTRATERRESTRIAL LIFE
Norman H. Horowitz 15 Aug. 1966 15 p Presented at the Am. Astronautical Soc., Anaheim, Calif., 23 May 1966
(Contract NAS7-100)
(NASA-CR-77550; JPL-TR-32-1000) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Chemical structures and mechanisms underlying the genetic properties of living matter are discussed with emphasis focused on the usefulness of the genetic definition of life in biological studies of extraterrestrial forms. On the basis of the genetic code, it is argued that the discovery of any significant change in the genetic codes of terrestrial life forms would constitute sufficient evidence for the separate origin of an extraterrestrial life form. The possibility of silicon-based extraterrestrial life forms is also discussed. It is concluded that because of its inherent chemical instability, silicon is not suited for the construction of the large, complex kinds of molecules that are associated with the living state. It is surmised that the discovery of any kind of life on Mars, even the simplest form, would be of the greatest scientific interest to our understanding of the origin of life. S.C.W.

N66-35243*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Control Lab.
BIOPHYSICAL EVALUATION OF THE HUMAN VESTIBULAR SYSTEM First Semiannual Status Report
J. L. Meiry and L. R. Young Jun. 1966 22 p
(Grant NGR-22-009-156)
(NASA-CR-77477; MU-66-2) CFSTI: HC $1.00/MF $0.50 CSCL 06P

The physical properties of the vestibular system and its fluids are investigated to determine an analytical model of the system. The theoretical response of the semicircular canals to caloric stimulation, angular rotation and linear acceleration is evaluated and compared to existing experimental data. Progress in experimentation with the labyrinthine fluids and in modeling of the semicircular canals is reported. Author

N66-35255# Stanford Research Inst., Menlo Park, Calif.
AN INVESTIGATION OF ACUTE SUBTLE EFFECTS OF MODERATE TO LOW DOSES OF RADIATION ON SYNAPTIC MECHANISMS Final Report, 1 Jan. 1965-31 Jan. 1966
Enrique J. A. Carregal 31 Jan. 1966 24 p refs
(Contract AT(04-3)-115)
(SRIA-115P53-1) CFSTI: HC $2.00/MF $0.50

Cats were either X-irradiated by whole-body exposure or were completely protected by a lead shield two inches thick, except for a hole, 1 cm in dia., directly over the exposed portion of the spinal cord. Dose rates used in the irradiations were in the range 7–350 R per min. On the basis of the results obtained, it was concluded that irradiation, within the dose range of 7 to 22,000 R, does somewhat affect the functions of the different components of the spinal monosynaptic arcs. However, some of the effects, even at the highest doses of radiation used, were so small that it is questionable whether they have any meaning in the performance capacity of the intact animal. The most significant findings were the changes occurring in the thresholds of both the pre- and postsynaptic elements of the monosynaptic reflex. Author (NSA)

N66-35268# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.
STUDIES ON THE RETENTION AND METABOLISM OF INHALED METHYL IODIDE: RETENTION OF METHYL IODIDE
D. J. Morgan and A. Morgan May 1966 28 p refs
(AERE-R-5117) CFSTI: HC $2.00/MF $0.50

Methyl iodide is one of the forms in which radio-iodine may be released in accidents involving fission products. To provide information to assist in the assessment of the radiological hazard resulting from its inhalation, a series of experiments was carried out with volunteer subjects to measure its retention. Values ranging from 53 to 92% were obtained, with a mean value of 72%. The retention is highly dependent upon respiratory rate, low rates being associated with high retention and vice versa. To study the effect of respiratory rate and tidal volume on retention, an additional series of experiments was carried out. These showed that there is negligible absorption of methyl iodide in the respiratory dead space and that at normal breathing rates, absorption from alveolar air is incomplete. An expression is derived which enables the retention to be calculated. Iodine-132 labelled methyl iodide was used in all these experiments, the average radiological dose to the thyroid being about 3 mrem. Author

N66-35274# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.
HEALTH PHYSICS AND MEDICAL DIVISION Annual Research Progress Report, Jan.–Dec. 1965
J. E. Johnston, ed. Jun. 1966 48 p refs
(AERE-PR/HPM-9) HMSO: 7s

Various health physics and medical research findings are reported in the areas of aerosols, radiation physics, and body radioactivity measurements. Progress was made in inhalation studies using human subjects, and a program on methyl iodide was completed. A program of field experiments on the deposition of iodine-131 was completed, and an analysis was made of the contributions of various parts of the boundary layer to the resistance to transport of gaseous elemental iodine to grass. In the field of biophysics a series of experiments was initiated to investigate the effect of various radiations on a simple biological system using recently found methods of dosimetry. The efficiency of body radioactivity measurement was greatly increased by using the GASP and other programs. A considerable number of investigations were carried out using subjects who had been accidentally contaminated, as well as subjects who inhaled, ingested, or were injected with radioactivity. C.T.C.

N66-35282# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
TRITIUM HAZARDS
W. R. Bush Jun. 1966 21 p
(AECL-2594) CFSTI: HC $1.00/MF $0.50

The absorption of tritium oxide into the body through the skin and lungs, its excretion in urine, and the administrative controls ("removal, caution, minor and negligible") are described. The concentration of tritium in air, expressed as $(MPC)_a$, and the radiation dose resulting from a number of $(MPC)_a$-hours of exposure are explained. Finally, the methods for protecting against tritium (ventilation, air-supplied masks, and plastic clothing) are discussed. Author

N66-35287# Istituto Superiore de Sanita, Rome (Italy). Laboratori di Fisica.
PROTECTION AGAINST X-RAYS FROM APPARATUS FOR MEDICAL USE [LA PROTEZIONE DALLE RADIAZIONI NEGLI IMPIANTI A RAGGI X PER USO MEDICO]
G. Missoni 20 Apr. 1966 42 p refs In ITALIAN; ENGLISH summary
(ISS-66/16) CFSTI: HC $2.00/MF $0.50

In this report the hazards of the use of X-rays in diagnosis and therapy are reviewed. The organization of protection from a technical and a legal point of view is illustrated and useful recommendations for carrying out the controls are given. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-34177# General Dynamics Corp., Groton, Conn. Electric Boat Div.
COMPUTER BASED ADAPTIVE TRAINING APPLIED TO SYMBOLIC DISPLAYS
Angelo Mirabello and Jerry C. Lamb Mar. 1966 62 p refs
(Contract N61339-1594)
(NAVTRADEVCEN-1594-1; AD-634338) CFSTI: HC $3.00/MF $0.75

Three experiments were conducted to explore the effects of adaptive vs. nonadaptive training upon performance in a visual target detection task involving symbolic data displays. The results indicated that increasing display complexity during training and requiring subjects to respond actively to the displays were more effective than maintaining a constant level of complexity and requiring only passive viewing of the displays. But there was no evidence to suggest that changing complexity in an adaptive fashion was more effective than changing complexity in an arbitrary stepwise fashion. Additional findings indicated that maintaining subjects at a high

nominal error rate during training was not necessarily detrimental to posttraining performance. A high error rate was at least as effective as a low rate, where the high rate was reached by increasing error rate in a stepwise fashion.
Author (TAB)

N66-34181# Human Engineering Labs., Aberdeen Proving Ground, Md.
NOISE LOCALIZATION AFTER UNILATERAL ATTENUATION
Robert W. Bauer, John L. Matuzsa, Raymond F. Blackmer, and Sam Glucksberg Apr. 1966 18 p refs
(TM-4-66; AD-634457) CFSTI: HC $1.00/MF $0.50

Partial hearing loss was simulated by insertion of V51-R plastic ear plugs. Subjects wore plugs continuously for periods ranging from six hours to three days. Predictable shifts in localization errors were observed when the stimulus was a broadband noise made up of frequencies above 3000 cycles per second. Reorientation in azimuth localization with ear plugs inserted required three days or more unless accelerated by specific training.
Author (TAB)

N66-34209# Swarthmore Coll., Pa. Dept. of Psychology.
EFFECT OF LEARNING ON THE VISUAL PERCEPTION OF DEPTH
Hans Wallach Aug. 1962 35 p refs
(Contract N61339-511)
(NAVTRADEVCEN-511-1; AD-634542) CFSTI: HC $2.00/MF $0.50

An investigation was made to explore the nature of learning, transfer, and forgetting in the visual perception of depth. Numerous preliminary experiments were conducted in order to find a situation in which the occurrence of perceptual learning could be convincingly demonstrated and cogently studied. The experiments that were finally selected for major emphasis dealt with stereoscopic depth perception (retinal disparity), and the kinetic depth effect, i.e., the cues that are due to rotation of a three-dimensional object or the observer's locomotion around the object.
TAB

N66-34215# System Development Corp., Santa Monica, Calif.
BINARY PREDICTION BEHAVIOR WHEN THE GENERATING SOURCE RESEMBLES A LANGUAGE
Burton R. Wolin and Rosemarie Weichel 31 Mar. 1966 24 p refs
(SP-1953/001/00; AD-633911) CFSTI: HC $1.00/MF $0.50

Complex learning behavior was investigated in a highly structured binary choice situation. The language-like generating source produced an event sequence which was completely defined by 17 different rules, two of these rules were stochastic. Interest was focused on the learning process and the presence or absence of artificial memory. Results demonstrated the importance of artificial memory, not so much in the kind of learning that occurred but in the rate, amount and completeness of the learning process. Ss who learned one rule well generally learned them all well, including the stochastic rules. There was no evidence that the learning process was strongly influnced by the hierarchical structure of the source, instead, learning was contingent upon the emergent structure of the event sequence.
Author (TAB)

N66-34225# College of Aeronautics, Cranfield (England).
AN ANNOTATED BIBLIOGRAPHY OF PRESENTATION OF INFORMATION IN AIRCRAFT COCKPITS
J. G. Fox, I. Ferguson, and I. D. C. Andrew London, Min. of Aviation, May 1966 80 p refs
(COA-M&P-73; S&T-Memo-3/66; AD-634575) CFSTI: HC $3.00/MF $0.75

Lists references to reports and published papers on all aspects of presenting information to pilots. Abstracts are given of work particularly relevant to cockpit instrument design. Only work reported since 1940 is listed; for earlier work the reader is referred to "A History of Aircraft Cockpit Instrumentation" by Nicklas (1958). References are listed alphabetically by author under six broad headings; general; methodology and criteria; pilot requirements; display presentation; system presentation; and pilot acceptance and training. The possibilities and directions for future research are discussed.
Author (TAB)

N66-34283# RAND Corp., Santa Monica, Calif.
STATISTICAL TECHNIQUES FOR DETECTING AND CLASSIFYING NEURONAL INTERACTIONS
Donald H. Perkel Jun. 1966 40 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4939-PR; AD-633924) CFSTI: HC $2.00/MF $0.50

An examination is made of mathematical techniques for comparing two simultaneously recorded neuronal spike trains and a presentation of a computer simulation using these techniques.
Author (TAB)

N66-34311*# Goodyear Aerospace Corp., Litchfield Park, Ariz.
THE DYNAMICS OF THE SEMICIRCULAR CANALS
Fernand Belanger and Robert Mayne 22 Nov. 1965 59 p refs
(Contract NAS9-4460)
(NASA-CR-65455; GERA-1085) CFSTI: HC $2.50/MF $0.75
CSCL 06B

Investigated is the theoretical response of the semicircular canals. Transfer functions are derived for the response to a steady-state sinusoidal input of displacement, velocity, and acceleration of the head. The response to various forms of transient inputs are then investigated, including sinusoidal, step, pulse, velocity and acceleration of the head. Responses to these various inputs were obtained by computer runs. The curves plotted from these data should simplify greatly computations of responses to the most common inputs of motion used by experimenters. The study of the response to a pulse input of velocity whereby the head is moved from one position to another led to unexpected results. The cupula overshoots the neutral position as the head is stopped, and the integrated velocity signal corresponds theoretically to a return of the head to the original position. The report discusses possible compensatory reactions to offset these erroneous sensory data.
Author

N66-34424# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE APPLICATION OF HYDROPHILIC AND HYDROPHOBIC SURFACES FOR PHASE SEPARATION IN A LOW-G ENVIRONMENT
J. M. Smith, R. M. Cima, and Yi-Sheng Li *In its* Fluid Mech. and Heat Transfer Under Low Gravity [1965] 20 p (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The separation of liquids and gases under low-g conditions is an important function in many spacecraft systems. In this paper the authors describe the use of hydrophobic (nonwetting) and hydrophilic (wetting) surfaces to control the water and gas phases in certain life-support equipment. The theoretical basis for the phase separation process is described, the

principles involved are demonstrated, a humidity-control system embodying these principles is described, and performance test data are presented for this system. Author

N66-34486# Joint Publications Research Service, Washington, D. C.

CYBERNETICS AND AUTOMATION

D. A. Oshanin, ed. 17 Aug. 1966 280 p refs Transl. into ENGLISH of the Book "Sistema Chelovek i Automat" Moscow, Nauka Publishing House, 1965 p 1-252 (JPRS-37072; TT-66-33501) CFSTI: $6.00

Articles on the problems and aims of the study of complex control systems, methods of studying "man and automaton" systems, regularities of human perception and processing of information, and studies of the functional capabilities of human operators are presented. For individual titles see N66-34487-N66-34514.

N66-34487# Joint Publications Research Service, Washington, D. C.

GENERAL PROBLEMS AND AIMS OF THE STUDY OF THE "MAN AND ATUOMATION" SYSTEM

M. G. Gaaze-Rapoport, A. Ya. Lerner, and D. A. Oshanin *In its* Cybernetics and Automation 17 Aug. 1966 p 1-11 (See N66-34486 20-05) CFSTI: $6.00

The continuous growth of mechanizstion and automation of manufacturing processes is discussed in relation to man's participation in these control systems. The man and automaton system is defined as one in which man makes extensive use of automatic controllers and through working with them performs the control functions. Basic problems are examined which seperate the man and automaton system from the general class of cybernetic systems into a relatively independent group. The systems are classified according to their purpose, man's place and role in them, and the character of the information exchange between the man and the automatic device. The problem of optimum distribution of functions within the framework of a single control system is also considered. The necessity for objectively classifying man's functional capabilities under different conditions of his interactions with the machine is stressed, along with the need for studying the specific properties and characteristics of automatic devices. Methodological problems are also discussed, with the establishment of a common language identified as the primary task. M.G.J.

N66-34488# Joint Publications Research Service, Washington, D. C.

ON SOME IDEOLOGICAL ASPECTS OF THE PROBLEM OF THE MAN AND AUTOMATON RELATIONSHIP IN A "MAN AND AUTOMATON" SYSTEM

V. N. Svintsitskiy *In its* Cybernetics and Automation 17 Aug. 1966 p 12-15 refs (See N66-34486 20-05) CFSTI: $6.00

The optimum distributions of the functions of people and automatic devices are discussed in relation to the character of the social order and political ideology of the particular society. Concepts which are said to exist in socialist and capitalist countries are discussed from the viewpoints of humanizing labor, social upheaval, and the degradation of human personality. The ideological aspects are examined, and it is pointed out that a purposeful functioning of complex self-perfecting automatons necessarily presupposes the existence of a link with man's purpose-setting activities. M.G.J.

N66-34489# Joint Publications Research Service, Washington, D. C.

SOME PROBLEMS OF THE STUDY OF COLLECTIVES OF PEOPLE PARTICIPATING IN THE CONTROL OF LARGE SYSTEMS

D. I. Iordanskiy *In its* Cybernetics and Automation 17 Aug. 1966 p 16-25 ref (See N66-34486 20-05) CFSTI: $6.00

Large systems are identified as ones in which people participate, and collective systems are defined as the entire assemblage (set) of people who participate in controlling a given large system. The problems inherent in classifying and studying both systems are considered, and the need for such definitive information in planning and organizing socialist economies is pointed out. A method is proposed in which the collectives are broken into groups and classes. Proceeding from the organizational or administrative structure, it is then possible to study the effect of the collectives of separate sections on the overall indices of an enterprise, and the role of people in large systems in relation to the functions performed by them. Two basic criteria are suggested as guides for more intensive studies: (1) the extent to which the listed and unlisted characteristics of the collectives are reflected in the indices of the functioning of large systems; and (2) the extent to which working conditions and system characteristics satisfy the material and spiritual needs of the collective members. M.G.J.

N66-34493# Joint Publications Research Service, Washington, D. C.

ON THE METHODS OF A PSYCHOLOGICAL STUDY OF THE OPERATOR'S ACTIVITY

Ye. A. Mileryan *In its* Cybernetics and Automation 17 Aug. 1966 p 50-58 refs (See N66-34486 20-05) CFSTI: $6.00

Psychological studies of four basic groups of operators indicate that each profession makes its own specific demands of the man. However, as the professional duties of the operators who control the most dissimilar systems are very similar in their psychological structure, it was possible to determine a structure of activity common for all professions. An experiment was designed which simulated the general structure of the operators' activities with different combinations of the components comprising it. Two series of investigations were conducted to study the process of the development of operating and observation abilities. Details on each are given, and the experimental data are assessed. Findings indicate considerable individual differences in the ability of the subjects to master the operator's profession. M.G.J.

N66-34494# Joint Publications Research Service, Washington, D. C.

ON THE CREATION OF A "MAN AND AUTOMATON" SYSTEM AND ON SOME ASPECTS OF ITS STUDY

V. F. Venda *In its* Cybernetics and Automation 17 Aug. 1966 p 59-67 refs (See N66-34486 20-05) CFSTI: $6.00

An example is given of a direct interaction of man and automaton in which the quality of the man's performance in controlling depends to a decisive degree on how the information received on the operations of the control computers is organized. A method of checking the data represented on the information panel is described, in which the theory of algorithms is used to analyze the mimic flowsheet of a large heating and power station. Details are also given on an experimental system, including a simulator of the boiler-turbogenerator unit. This was developed in connection with an actual problem of designing the operator's station at a large thermal power unit completely automated with the use of a control computer. The importance of the operator's role is stressed

in relation to the station design. Factors to be considered are listed as choice of information panel and method of depicting the controlled object; arrangement of signal elements and density of their distribution; color characteristics of the information panel and control desk; type of monitoring and measuring equipment, and the design of its reading parts; and the work room design. M.G.J.

N66-34497# Joint Publications Research Service, Washington, D. C.

ON THE FEASIBILITY OF SOLVING THE PROBLEMS OF THE DIAGNOSTICS OF MAN'S FUNCTIONAL CONDITION WITH THE HELP OF COMPUTERS

R. S. Dadashev and Ye. N. Murashov *In its* Cybernetics and Automation 17 Aug. 1966 p 92–112 refs (See N66-34486 20-05) CFSTI: $6.00

The problem of man and automation is examined with regard to checking the functional condition of man, especially the sick man, as the operator in a complex control system. The approach consists of an examination of methods of statistical processing of physiological parameters and storage of the results in the computer for automatic diagnosing. Values of a physiological parameter were obtained as a random quantity with a normal distribution law. Another approach to the problem is devoted to the probability methods in which the computer itself works out regions of symptom complexes with a small number of experiments, and during the diagnosis compares the current condition with the regions of conditions found automatically. Probability methods are applicable for determining the functional condition when there is no accumulated clinical material. A block diagram of a specialized computer for automatic diagnosis of man's functional condition is included. This automatic diagnosis predetermines the onset of a condition with a certain probability, making it possible to avoid extreme conditions in time. S.P.

N66-34498# Joint Publications Research Service, Washington, D. C.

ON AN INTEGRAL METHOD OF EVALUATING THE DEGREE OF THE OPERATORS' TRAINING IN THE CONTROL SYSTEMS

A. A. Bulat, V. G. Denisov, A. P. Kuz'minov, V. F. Onishchenko, Yu. A. Rozanov et al *In its* Cybernetics and Automation 17 Aug. 1966 p 113–120 refs (See N66-34486 20-05) CFSTI: $6.00

An experiment is reported in which the methods of electrophysiology were used to characterize the skill development process in controlling a spacecraft. These methods were used in objectively considering some reorganization aspects of the operators neuropsychic region on the basis of data from electroencephalograms, electromyograms, electrocardiograms, cutaneogalvanic reactions, and pneumograms. Initial stages in the formation of complex sensomotorial skills in systems control were characterized by a considerable irradiation of the excitation process and asynchronous functioning of various centers of the cerebral cortex and subcortex. This resulted in heightening of the bioelectrical activity of the high frequency rhythms of the cerebral cortex, bioelectrical activity of the muscles, amplitude of the cutaneogalvanic reaction, and heart rate. A diagram of an overall recording of the electro-physiological indices of the operator in the process of training is included. C.T.C.

N66-34499# Joint Publications Research Service, Washington, D. C.

THE RATE OF THE RECEPTION OF INFORMATION BY MAN AND THE CONSCIOUS-VOLUNTARY CONTROL OF HUMAN ACTIVITY

O. A. Konopkin *In its* Cybernetics and Automation 17 Aug. 1966 p 121–129 (See N66-34486 20-05) CFSTI: $6.00

Consideration is given to determining the operator rate of transmitting information from the indicating elements to the control elements in a complex control system. The initial assumptions in studying man as a communication system are connected with the recognition of the amount of the stimulus information determined by the probability relationships in a series of signals. Data were obtained which indicate that the rate of the reception of information by man depends on the conscious-voluntary control by him of his activity. Two groups of experiments are emphasized: the first pertains to a study of the signal presentation rate, and the second is associated with the probability role of the signals. C.T.C.

N66-34500# Joint Publications Research Service, Washington, D. C.

A STUDY OF THE RATE OF INFORMATION PROCESSING BY HUMAN OPERATOR IN SOLVING THE PRACTICAL PROBLEMS OF ENGINEERING DIAGNOSTICS

A. I. Galaktionov *In its* Cybernetics and Automation 17 Aug. 1966 p 130–148 (See N66-34486 20-05) CFSTI: $6.00

An investigation was made of man's information processing rate in connection with a "man–machine" system in order to determine: (1) what portion of the information flow running from the controlled object has to be directed into the automatic device, (2) how many control boards are necessary for each specific production facility, and (3) how to evaluate quantitatively the methods and means of presenting the information. Relative to this an experiment was conducted in which K (number of components of an event) signals were presented simultaneously, one from each component; and the subject's task was to name all of the signals presented. Basic formulations were that each event was identified by several signs, and that each successive sign was dependent on the sign selected at the preceding step of a complex multi-step selection. A distinguishing aspect of the investigation was the approximation of the actual working conditions. C.T.C.

N66-34501# Joint Publications Research Service, Washington, D. C.

THE DEPENDENCE OF THE SELECTION REACTION TIME ON THE AMOUNT OF INDIVIDUAL AND AVERAGE INFORMATION

Ye. P. Krinchik *In its* Cybernetics and Automation 17 Aug. 1966 p 149–155 refs (See N66-34486 20-05) CFSTI: $6.00

A comparative study was conducted on the influence of two information measures, average information and amount of information, on the reaction time of selection by a human operator. Experimental data were obtained in 420 experiments with six subjects being tested, and a total of 240 reactions were measured in each experiment. The results indicate that the two information measures being compared produce an effect which is considerably different both in character and in magnitude. It is shown that the degree of selection complexity exerts a considerably more substantial influence on man's behavior in the situation of selection than the degree of signal unexpectedness. The study also has shown that two interconnected types of uncertainty, time uncertainty and alternative uncertainty, are contained in a situation simulating the process of information transmission, and that man copes with time uncertainty considerably easier than with alternative uncertainty. A.G.O.

N66-34502# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF THE SIGNAL-SIGNIFICANCE FACTOR ON THE COURSE OF PROCESSING THE INFORMATION BY MAN

Ye. P. Krinchik and S. L. Ryabkova *In its* Cybernetics and Automation 17 Aug. 1966 p 156–161 refs (See N66-34486 20-05) CFSTI: $6.00

The influence of the degree of signal significance on the processing of information by man in a situation involving selection was studied. Analysis of test results indicated that considerable reduction of time for the reaction to emergency signals in terms of absolute value had taken place. It is noted that this effect is achieved by means of a special readjustment of the perception and reaction to the signals. The subjective attitude of the man toward the signals changes and this creates in him a state of heightened alertness in regard to the especially significant signals. The data obtained show that the introduction of the factor of signal significance leads to an intensification of the information perception process by man, and it is stated that the degree of signal significance may be regarded as one of the important stimuli for raising the rate of information processing by an operator. Test results also showed that a change in both reaction time and rate of information processing is brought about in accordance with the degree of the significance of a signal, which formed in the subject under the effect of one type of reinforcement or another. A.G.O.

N66-34504# Joint Publications Research Service, Washington, D. C.

A STUDY OF THE PROCESS OF FORMATION OF THE IMAGE OF A BINARY TIME SEQUENCE

A. M. Parachev *In its* Cybernetics and Automation 17 Aug. 1966 p 167–172 refs (See N66-34486 20-05) CFSTI: $6.00

An experiment is described for studying man's behavior in a determinate medium consisting of a sequence of binary symbols (zeroes and ones) written in a random manner and having a definite length. The test procedure is illustrated and results are enumerated. Heuristic rules used by subjects in solving the problem are discussed. A heuristic automaton which includes units for identification, condensation of information, and operational memory is proposed to assist the stochastic automaton with variable memory. The complex interaction between these two automatons is briefly described. S.P.

N66-34505# Joint Publications Research Service, Washington, D. C.

HICK'S LAW AND THE FACTOR OF THE GENERALIZATION OF PERCEIVED OBJECTS

B. B. Kossov *In its* Cybernetics and Automation 17 Aug. 1966 p 173–177 (See N66-34486 20-05) CFSTI: $6.00

Distinguishability of stimuli, compatibility of reactions, and perception of structural elements are offered as factors which overshadow the effect of Hick's law pertaining to disjunctive-reaction time. Investigations indicated that the stimuli used to test Hick's law had no such common characteristics that could be used by the subject to generalize. Two hypotheses dealing with the generalization of perceived objects by man are proposed. A series of experiments is described, and it is concluded that disjunctive-reaction time is a finer indicator of generalized associations than the generally accepted criteria of verbal report and reproduction of stimuli. The question of how the forming of generalized associations and distinguishing of an appropriate common characteristics of objects in the perception are correlated is briefly examined. S.P.

N66-34506# Joint Publications Research Service, Washington, D. C.

ON A DIFFERENT CONCEPT OF THE PROCESS OF RECOGNITION

M. S. Shekhter *In its* Cybernetics and Automation 17 Aug. 1966 p 178–182 refs (See N66-34486 20-05) CFSTI: $6.00

An element of signal recognition—the process of comparison—is discussed in terms of its importance in psychological studies of perception. It is stated that many researchers attempt to conceive the mechanisms of recognition without going beyond the limits of the classical, Pavlovian concepts. Their investigations assume that the track from each signal has its own location in the cortex, and when a signal acts on the sense organs, the incoming afferent information reaches that area of the cortex where the track of this signal is located. These assumptions are challenged and the role of the process of comparison in signal recognition is evaluated. H.S.W.

N66-34507# Joint Publications Research Service, Washington, D. C.

UTILIZATION OF THE ATTRIBUTES OF PERCEPTION IN MACHINE IDENTIFICATION

V. A. Makhonin *In its* Cybernetics and Automation 17 Aug. 1966 p 183–185 (See N66-34486 20-05) CFSTI: $6.00

A human like classification of signals is often required in machine identification. An automaton's solution must remain constant with the changes in the description signals. Therefore, it is useful to have the attributes of constancy and integrity of perception in an automaton which performs human like classification. An automaton can be endowed with the property of constancy by providing it with devices for reducing the descriptions to a standard form invariant relative to the group of transformations interlinking the descriptions for one class. Descriptions linked by different groups of transformations may fall into one class according to the type of the objects. A special study showed that with slight limitations on the method of spelling, the written numerals are reduced well by a transformation of the designed group. However, a reduction is useless when it is necessary to deal with a change in the description accompanied by a loss of information due to the limited capabilities of the system of data units and interference effect of extraneous objects. To combat such changes, the automaton must have the property of integrity of perception, especially in identifying volume bodies in the observation from one side. R.N.A.

N66-34508# Joint Publications Research Service, Washington, D. C.

A STUDY OF STATISTICAL CHARACTERISTICS OF HUMAN OPERATOR IN THE CASE OF NON-STEADY-STATE INPUT ACTIONS

G. A. Sergeyev, G. V. Sukhodol'skiy, and V. M. Vodlozerov *In its* Cybernetics and Automation 17 Aug. 1966 p 186–198 refs (See N66-34486 20-05) CFSTI: $6.00

A study of the dependence of the statistical structure of human operator output errors on the characteristics of nonsteady state input actions in a man/automaton system, is reported. To determine the degree of nonlinear transformation of data by a human operator, observations were made of an operator pursuing a moving target. A system containing two control circuits, an exteroceptive circuit and a proprioceptive circuit, were examined as a hypothetical simulator of the human operator's tracking system in the pursuit mode. The characteristics of the correlation functions of the components of the human operator's errors at different stages of

training were examined. It is concluded that it is most expedient to use an operator in those structural elements of a man/automaton system that are characterized by a high degree of the nonsteady state properties of the control signals. It was further concluded that if it is necessary to link a human operator with the technical elements of a control system, the dynamic characteristics of these elements must be chosen in order to provide conditions of high stability which consider the possible variability of the frequency of human operator error. S.C.W.

N66-34509# Joint Publications Research Service, Washington, D. C.

THE RESULTS OF A STUDY OF SOME CONDITIONS OF OPERATOR'S PERFORMANCE

L. V. Gavrilov, V. I. Nikolayev, and V. N. Temnov *In its* Cybernetics and Automation 17 Aug. 1966 p 199-216 refs (See N66-34486 20-05) CFSTI: $6.00

The high efficiency required in the operation of a complex man–machine system largely depends on the mutual adaptation of man and machine as elements of a single complex control system. Determining the character of the interaction of the operator and of the elements of the system linked with him is a necessary condition for a rational design of the control systems. The circulation and processing of information are of fundamental importance in the control processes. The character of the operator's interaction as an element of the control system is determined by the functions which the operator performs in circulating and processing the information. Experiments are described which were conducted to determine the main factors affecting the length of time which an operator spends in performing his role as a receiver of information, an information analyzer, and an executor of commands. R.N.A.

N66-34510# Joint Publications Research Service, Washington, D. C.

ON THE STRUCTURE OF A COMMAND SIGNAL AND THE OPERATOR'S PSYCHOPHSIOLOGICAL CAPABILITIES FOR CONTROL UNDER THE CONDITIONS OF OVERLOADS

A. A. Volkov, V. G. Denisov, Yu. I. Kirilenko, V. I. Mankevich, S. G. Mel'nik et al *In its* Cybernetics and Automation 17 Aug. 1966 p 217-231 (See N66-34486 20-05) CFSTI: $6.00

A study was conducted on the structure of a command single and the psychophysiological effect of overload conditions on a human operator's capability for control. The study shows that under overload conditions, an operator can control angular and trajectory motions if he receives a single control command. The structure of the control command must be identical to the formula for controlling an automatic system. Selecting the optimum structure of a control command may be done by methods used for automatic control systems. The quality of controlling an object is greatly affected by its dynamic characteristics, by the preparation and degree of training of the operator, by the effect of the disturbing factors, and by the organization of the operator's work place. Data from the polyeffector method of recording physiological functions, show that an increase in overload on an operator leads to control functions which are performed with a great neuropsychic strain and a decline in work quality. The processes affecting an operator's control of an object can be evaluated by analyzing dynamic parameters of the object's motions, the operator's actions, and his psychophysiological strain. R.N.A.

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N66-34511# Joint Publications Research Service, Washington, D. C.

ON THE PROBLEM OF PROFESSIONAL FITNESS AND HANDLING CAPACITY OF THE OPERATORS

K. M. Gurevich and L. M. Edel'man *In its* Cybernetics and Automation 17 Aug. 1966 p 232-236 (See N66-34486 20-05) CFSTI: $6.00

This study examines the professional fitness of personnel handling the control desks of electric power installations in terms of their behavior under emergency conditions. Simulated emergency exercises were conducted to observe and evaluate the ability of operators to eliminate an emergency condition. No connection was found between the success of eliminating an emergency and the length of service or special skills of an operator. The repeatedly observed cases of a loss of composure by workers in which grossly mistaken actions were performed indicate that these workers must have some individual peculiarities which to a certain degree predetermine such behavior. R.N.A.

N66-34512# Joint Publications Research Service, Washington, D. C.

PREDICTION AND PROBABILITY AS AN INDICATOR OF MAN'S OPERATIONAL EFFICIENCY

L. S. Khachatur'yants *In its* Cybernetics and Automation 17 Aug. 1966 p 237-243 (See N66-34486 20-05) CFSTI: $8.00

To investigate the influence of active probability prediction by an operator of a man machine system, a series of experiments were conducted. The basic procedural method of work consisted in studying a human operator's reactions to two different steady state types of activity and in studying the effects of external stimuli on the system. The data obtained from these investigations are summarized and evaluated. H.S.W.

N66-34513# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF OVERLOAD AND HYPODYNAMIA ON THE OPERATOR'S REACTION

L. I. Kakurin, A. R. Kotovskaya, V. K. Filosofov, N. A. Chekhonadskiy, and V. A. Chichkin *In its* Cybernetics and Automation 17 Aug. 1966 p 244-247 refs (See N66-34486 20-05) CFSTI: $6.00

The results of a study of the effect of overload and hypodynamia on an operator's reaction in the processing of single visual signals presented in a random manner are given. The experimental procedure is described and graphs which summarize the data obtained are included. It was found that during the action of an overload, the time for an operator's reaction to a light signal increases. Additionally it was determined that hypodynamia also increased the operator's reaction time. H.S.W.

N66-34514# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF SHORT DURATION WEIGHTLESSNESS AND OF THE COMBINED EFFECT OF WEIGHTLESSNESS, ANGULAR AND CORIOLIS ACCELERATIONS ON SOME WORK FUNCTIONS OF THE OPERATOR

L. A. Kitayev-Smyk and A. T. Zverev *In its* Cybernetics and Automation 17 Aug. 1966 p 248-259 refs (See N66-34486 20-05) CFSTI: $6.00

It has been postulated that by creating an artificial gravity in a spacecraft, man's capacity to endure a weightless environment could be increased. It is further stated that this task could be best realized by creating a rotating spacecraft. However, in a rotating system, man will be experiencing the effects of angular and Coriolis accelerations which may cause undesirable vestibulovegetative and vestibulosomatic reactions. This study was conducted to investigate the combined

effects of weightlessness and angular acceleration. The recorded data showed an increase in the latent period before a reaction during weightlessness, and a decrease in this period during overload; however, the subjects stated that during the weightlessness they worked faster and more accurately than during overload. During combined weightlessness and Coriolis acceleration, vestibulovegetative reactions appeared. Additional results from the tests are presented and evaluated. H.S.W.

N66-34608*# Melpar, Inc., Falls Church, Va.
HUMAN PERFORMANCE CONTROL MONITORING SYSTEM Final Report, Jan. 1965–Feb. 1966
R. E. Mirabelli et al Mar. 1966 87 p refs
(Contract NASw-1085)
(NASA-CR-77272) CFSTI: HC $3.00/MF $0.75 CSCL 06B

A mathematical model of a performance control and monitoring system, and applications for trainable logic in the areas of computation and controls were developed for possible application in more complicated systems. Computational techniques and performance control systems are described. A computer program simulated a second-order servo controlled by an adaptive logic element trained by monitoring of human performance, and the system behavior was observed through experimentation. The trainable logical network concept was extended into a tool for adaptive decision making. Types of decision processes and their association decision criteria are identified. A mathematical model of the adaptive decision process was developed and evaluated by applying it to a problem of control; the results were encouraging for the sample plant and performance index chosen. R.Ll.

N66-34620# Human Factors Research, Inc., Santa Barbara Calif.
GEOGRAPHIC ORIENTATION IN AIRCRAFT PILOTS: CONTEMPORARY CHARTS AND PILOT PERFORMANCE
William E. Osterhoff and James J. Mc Grath May 1966 49 p refs
(Contract Nonr-4218(00))
(TR-751-6; AD-635384) CFSTI: HC $4.00/MF $0.50

Three different aeronautical charts were evaluated in terms of their relative effectiveness as visual navigation aids. Geographic orientation performances of three groups of pilots were measured under conditions of simulated, VFR, flight. One group used the Sectional Aeronautical Chart. Another used the operational navigation chart (ONC), and a third used the pilotage chart (PC). After a practice sortie, each pilot flew two test sorties over different routes of simulated flight. The poorest performances were achieved with the PC on one route and with the ONC on the other route. Pilots using the Sectional performed as well as or better than those using either the PC or the ONC on both routes. It was concluded that the relative effectiveness of aeronautical charts is specific to the terrain over which the pilots must navigate. The PC was an effective navigation aid when used over terrain having a substantial number of visual landmarks, but was less effective than the other charts when used over terrain having few available landmarks. Author (TAB)

N66-34687# Royal Aircraft Establishment, Farnborough (England).
COAXIAL MICROELECTRODES FOR INTRACELLULAR PICK-UP OF BIOPOTENTIALS [KOAKSIAL'NYE MIKROELECTRODY DLYA VNUTRIKLETOCHNOGO OTVEDENIYA BIOPOTENTSIALOV]
I. V. Batuyeva Jun. 1966 14 p refs Transl. into ENGLISH from Tsitologiya (Leningrad), v. 6, no. 6, 1964 p 772–774
(RAE-LIB-TRANS-1168) CFSTI: HC $1.00/MF $0.50

The technique of making of coaxial microelectrodes has been described. The tip diameter of the inner barrel is under 1.0, that of the outer one is 1.5–2 mc and the distance between the tips is 1–4 mc. The low coupling resistance of the microelectrodes (100–200 kΩ), their form and mechanical properties make it possible to use them for investigation of cell electrical parameters. Author

N66-34862*# General American Transportation Corp., Niles, Ill. MRD Div.
A WASTE MANAGEMENT SUBSYSTEM Final Technical Report
Jerry Rast, Thomas L. Hurley, and Jack D. Zeff Dec. 1963 106 p refs
(Contract NAS1-2193)
(NASA-CR-66124; MR-1210-8090) CFSTI: HC $4.00/MF $0.75 CSCL 06K

This report summarizes the development, evaluation and delivery of a flight prototype waste management subsystem, as part of a life-support system for manned orbiting space stations. The subsystem provides for the collection, processing and storage of the urine and fecal wastes produced by three or four men for a period of at least 60 days without resupply. Feces are collected by pneumatic transfer techniques and then dried for storage in plastic bags. Urine is also collected by pneumatic transfer techniques, and then separated from entrained gas before it is pumped to a bladder-type storage tank. The subsystem contains a vacuum distillation unit for recovering potable water from urine. Thermoelectric techniques are used to pumping latent heat from the condenser to the evaporator. A reliability analysis indicates that dynamic seals, thermoelectric junctions and vacuum disconnects must be designed for in-flight maintenance to achieve a high operational reliability. Tests have shown that the system can store processed fecal matter for at least 75 days; but additional testing is recommended. Author

N66-34888# California Univ., Los Angeles. Dept. of Engineering.
DIGITAL COMPUTER SIMULATION OF A SIMPLIFIED NERVE NET
Shiang Fan Liu May 1966 117 p refs
(Contracts Nonr-233(52); AT(11-1)-GEN-10)
(Rept.-66-30; AD-634289) CFSTI: HC $4.00/MF $0.75

A neural model of a diffuse, randomly connected two-dimensional network based on the anatomical and physiological evidence of coelenterate nerve nets was constructed and simulated on a digital computer. An experimental on-line nerve net simulation system equipped with a CRT display unit and on-line input keyboards was developed, so that the response of the simulated net could be directly observed and human judgment used during the computation. The response of the model to different input-parameters was investigated and the factors which affect the spread of excitation were evaluated. The results of the experiments performed showed that: (1) the proportion of transmissive junctions of the net is the dominant factor in determining the characteristics of the response; (2) the length of the advancing front of the excitation spread is one of the factors which influence the distance of spread; (3) three types of excitation spread following repetitive stimulation exist, namely, spread in decreasing distance increments, spread in equal distance increments, and spread in increasing distance increments. The last type of spread is not very well confirmed due to the small size of the net. Author (TAB)

N66-34959# Applied Psychological Services, Wayne, Pa.
CONSPICUITY OF FLUORESCENT AND NON-FLUORESCENT STIMULI Final Report, Apr. 1964–Mar. 1966
Arthur I. Siegel, Richard S. Lanternman, John Lazo, Edmund C. Gifford, and Joseph R. Provost (Aerospace Crew Equipment Lab.) Philadelphia, Pa., Naval Air Eng. Center, 1 Jun. 1966 37 p refs
(Contract N156-44911)
(NAEC-ACEL-537; AD-635393) CFSTI: HC $2.00/MF $0.50

Two investigations were performed into the conspicuity of stimuli equated for luminance, but of different purity and of different dominant wave length. In these experiments, subjects performed a simulated flight and responded to the stimuli as the stimuli appeared at various azimuth locations against a simulated sky background. The results supported the contention that purity will affect detection time in the simulated flight situation and that wave length also exerts an important effect. Author (TAB)

N66-35082# Cincinnati Univ., Ohio.
AN EXPERIMENTAL COMPARISON OF AN INTRINSICALLY PROGRAMMED TEXT AND A NARRATIVE TEXT Final Report, Sep. 1964–Sep. 1965
R. J. Senter, John S. Abma, Kirk A. Johnson, and Ross L. Morgan (AMRL, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio, AMRL, Mar. 1966 32 p refs
(Contract AF 33(615)-1046)
(AMRL-TR-65-227; AD-635001) CFSTI: HC $2.00/MF $0.50

The study compared three methods of instruction in binary and octal arithmetic, i.e.: (1) Norman Crowder's branched programmed text, The Arithmetic of Computers; (2) another version of this text modified so that subjects could not see the instructional material while answering 'branching' questions; and (3) a narrative text version presenting the same content material. The principal behavioral measure was relative performance on a pre- and post-training criterion test. The results indicated that prohibiting visual contact with instructional material while answering questions significantly increased the number of erroneous alternatives selected by the subjects, but did not significantly alter the amount of learning manifested nor the time necessary to complete training. The programmed instructional methods resulted in significantly greater improvement on the criterion test than was attained by using the narrative text. The time to complete instruction was significantly less with the narrative text version of the material. Although, in general, less informational content was imparted with the narrative text, the study time necessary per unit improvement was significantly less with that version. Records were kept of the number of 'wrong answer' branches taken by the subjects receiving instruction via the branched programs. Only about 6% of the total possible 'wrong' branches were actually taken. This suggests that branched programming may be wasteful by virtue of providing a quantity of material that is never studied.
Author (TAB)

N66-35213*# Stanford Univ., Calif.
EFFECTS OF TIME DELAY IN THE VISUAL FEEDBACK LOOP OF A MAN–MACHINE SYSTEM
John Mc Lean Leslie Washington, NASA, Sep. 1966 121 p refs
(Grant NsG-111-61)
(NASA-CR-560) CFSTI: HC $3.00/MF $1.00 CSCL 05H

This thesis was aimed at studying the effects of time delay in the visual feedback loop of a man–machine system. A one-dimensional, step-type input, pursuit tracking experiment was developed to study these effects with transmission-type delays of zero to ten seconds. Thirty-six subjects participated in a series of tests that covered: seven different delays, two different levels of course complexity for each delay, learning, and open-loop conditions. It was found that tracking performance deteriorates non-linearly with increase in delay and that the magnitude of this performance degradation is a function of course complexity. Author

N66-35321*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
AN IMPROVED WATER RECLAMATION SYSTEM UTILIZING A MEMBRANE VAPOR DIFFUSION STILL CONCEPT
W. B. Coe and H. J. Kolnsberg [1966] 114 p refs
(Contract NAS1-5312)
(NASA-CR-66154; SVHSER-4082) CFSTI: HC $3.00/MF $0.75 CSCL 06K

A laboratory model of an improved water reclamation system based upon the membrane diffusion still concept was analyzed, designed, and constructed. Its performance was demonstrated by means of a 116 hour test on a 1/5 scale system. The system achieved predicted processing rate and successfully recovered 98% of the available water. The water reclaimed from urine during the test was of potable quality throughout. A conceptual design to determine prototype weight and thermal losses, based upon the test results achieved in this program, indicates an achievable launch weight per man of less than 7.5 lbs with an expendable weight of .0716 lbs per man day. Factors which influence this performance indicate the potentiality of the system for improvements in performance as the result of further development. In order to obtain a high degree of reliability and further improve the system capability, additional effort is recommended to investigate membranes and membrane properties as applied to the membrane diffusion still concept. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-34123# Naval Research Lab., Washington, D. C.
SOLUTION SYSTEMS FOR THE DISPLACING OF ORGANIC LIQUIDS FROM SOLID SURFACES
Marianne K. Bennett and W. A. Zisman 25 May 1966 13 p refs
(NRL-6402; AD-634425) CFSTI: HC $1.00/MF $0.50

Many liquid organic compounds that are effective in surface chemically displacing an adhering layer of a nonaqueous liquid from a solid surface are also effective when used in a solution in an appropriate nonaqueous solvent. Besides reducing the necessary quantity of active solute, the use of a solvent also greatly increases the variety of compounds effective in surface-chemical displacement by including compounds which are either solid (or very viscous) at ordinary temperatures. These principles were established by experiments on displacing hexadecane, propylene carbonate, and Navy special fuel oil from the solid, clean surfaces of SAE 1020 steel, borosilicate glass, and a variety of polymeric organic solids used as insulating materials. Solvents used included common hydrocarbons, fluorinated hydrocarbons, or a combination of either. It was found that highly fluorinated alkanols and low-molecular weight dimethyl silicones were especially well suited for temporary oil displacement when

used in concentrations of only 0.05 to 5.0 wt-%. The duration of liquid displacement could be increased greatly by adding small concentrations (0.1 wt-%) of a compound capable of adsorbing from solution to form an oleophobic film on the solid surface; stearic acid and the higher molecular weight dimethyl silicones are good examples. Permanent oil-displacement from any type of surface was obtained by using concentrations as low as 0.02 wt-% of certain types of progressively fluorinated fatty acids. Applications of the solutions were equally effective whether they were by a dynamic means, such as by spraying or flushing, or by a combination of solution and subsequent competitive adsorption, such as by dipping or immersing. Author (TAB)

N66-34148# Louvain Univ. (Belgium). Lab. of Inorganic Chemistry.

CHEMI-IONIZATION PROCESSES Annual Summary Scientific Report No. 1

A. Van Tiggelen and S. De Jaegere May 1966 58 p refs (Grant AF-EOAR-65-82)

(ARL-66-0099; AD-633619) CFSTI: HC $3.00/MF $0.50

CONTENTS:

1. STUDY OF ELECTRON TRANSFER PROCESSES J. Peeters 28 p refs (See N66-34149 20-06)
2. STUDY OF CHEMI-IONIZATION BY FLASHPHOTOLYSIS J. D'Olieslager and L. Lowet 16 p refs (See N66-34150 20-06)

N66-34149# Louvain Univ. (Belgium).

STUDY OF ELECTRON TRANSFER PROCESSES

J. Peeters *In its* Chemi-Ionization Processes May 1966 28 p refs (See N66-34148 20-06) CFSTI: HC $3.00/MF $0.50

The characteristics of isentropic expansion indicate that sampling orifices used for the extraction of ions from a flame burning at atmospheric pressure should be kept as small as possible if kinetics of ion reactions are to be investigated. A previously used intermittent extraction system was replaced by a continuous aperture system with small orifice diameter. Furthermore the lens support of the mass spectrometer extraction chamber is modified and a Mecker burner will be used instead of the classic Bartholome-profile burner. The vibrating reed electrometer has been replaced by a more sensitive instrument with faster response. Author

N66-34150# Louvain Univ. (Belgium).

STUDY OF CHEMI-IONIZATION BY FLASHPHOTOLYSIS

J. D'Olieslager and L. Lowet *In its* Chemi-Ionization Processes May 1966 16 p refs (See N66-34148 20-06) CFSTI: HC $3.00/MF $0.50

A description is given of the construction of a new flash-photolysis apparatus, applied to the measurement of chemi-ionization reactions. A discussion is made of the requirements for the flash equipment. A conductimetric method for the measurement of the absolute value of the ion concentration is proposed. The possibility of isolating the different chemi-ionization reactions possible in flames through the flashconductimetric method is discussed. Author

N66-34156# Electric Storage Battery Co., Yardley, Pa. Carl F. Norberg Research Center.

HIGH ENERGY SYSTEM (ORGANIC ELECTROLYTE) Third Quarterly Report, 15 Dec. 1965–15 Mar. 1966

D. P. Boden, H. R. Buhner, and V. J. Spera Jun. 1966 102 p refs *Its* Rept.-3

(Contract DA-28-043-AMC-01394(E))

(ECOM-01394-3; MD-634491) CFSTI: HC $4.00/MF $0.75

The study of high energy density systems included: continued investigation of new electrolyte solvents; corrosion and solubility studies of cathode and anode materials in various electrolytes; a study of the reversibility of glass electrodes in non-aqueous electrolytes; continued efforts to optimize CuF_2 cathode performance; a study of the effect of electrolyte concentration and discharge current density on cathode performance; lithium anode storage tests; evaluation of various separator materials; construction and testing of Li–CuF_2 cells in lightweight polyethylene cases. Author (TAB)

N66-34161# Tyco Labs., Inc., Waltham, Mass.

RESEARCH STUDIES ON SOLID HYDROGEN PURIFICATION MEMBRANES Interim Technical Report, 15 Jun. 1965–15 Apr. 1966

M. Wright, D. Jewett, and A. C. Makrides [1966] 35 p refs

(Contract DA-44-009-AMC-1183(T))

(ITR-1; AD-634547) CFSTI: HC $2.00/MF $0.50

The permeation rate of hydrogen through tantalum was measured over the temperature range of 400–700°C and at pressures up to 160 psig. Tantalum membranes coated with a thin palladium layer, approximately 1000 Å thick, are stable between 400° and 525°C and show rates which are limited by bulk, solid state diffusion of hydrogen. The diffusion rate through these membranes is substantially greater than that through palladium of the same thickness under the same temperature and pressure. At lower temperatures the tantalum membranes are mechanically unstable because of the lattice expansion caused by the solution of large quantities of hydrogen. At temperatures above 525°C, the surface coat degrades with time. The susceptibility to poisoning of tantalum membranes coated by palladium is essentially that of pure palladium. The membranes are stable in air at room temperature and at elevated temperatures. Carbon dioxide and carbon monoxide decrease the permeation rate of hydrogen, but the effect is small and is easily reversible. Hydrogen sulfide decreases the rate of permeation substantially, and its effect is only partially reversed by replacing the gas with pure hydrogen. Preliminary measurements with Ta–5 at % Pd membranes show that this alloy also has a substantial rate for permeation by hydrogen. Author (TAB)

N66-34169# Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.

ULTRASONIC VIBRATION POTENTIALS AND THEIR USE IN THE DETERMINATION OF IONIC PARTIAL MOLAL VOLUMES

Raoul Zana and Ernest Yeager 6 Jun. 1966 54 p refs

(Contract Nonr-1439(04))

(TR-29; AD-634576) CFSTI: HC $3.00/MF $0.50

The propagation of ultrasonic waves through an ionic solution gives rise to alternating potential differences (ionic vibration potentials) within the solution as a result of differences in the dynamic reactions of the cations and aniens to the acoustical waves. The amplitude of the effect is a function of the masses of the solvated ions minus the mass of the free solvent displaced by each ion. Experimental studies were carried out with many electrolytes with particular attention to the elimination of possible false effects. The observed dependence of the ionic vibration potentials on various parameters is in good agreement with theory. From ionic vibration potentials and density data. The absolute values for the ionic partial molal volumes were determined for a number of simple monovalent ions without any assumption as to the value for a given ion or the ratio of values for any pair of ions. Author (TAB)

N66-34184# Illinois Univ., Urbana. Noyes Chemical Lab.
HIGH TEMPERATURE GAS KINETIC STUDY OF CARBONYL SULFIDE DECOMPOSITION PERFORMED WITH A SHOCK TUBE AND QUADRUPOLE MASS-FILTER
Arthur James Hay Feb. 1966 112 p refs *Its* Res. Rept.-3
(Grants AFOSR-62-245; AFOSR-588-64)
(AFOSR-66-0958; AD-634423) CFSTI: HC $4.00/MF $0.75

A quadrupole mass-filter coupled to a shock-tube was used to study high temperature gas kinetics. The chemical kinetics of the thermal decomposition of carbonyl sulfide was studied with this apparatus in order to establish the mechanism of the reaction in the temperature range 2000 to 3200°K. Author (TAB)

N66-34187*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
STUDIES IN FUNDAMENTAL CHEMISTRY OF FUEL CELL REACTIONS Semiannual Progress Report No. 8, 1 Jan.–30 Jun. 1966
John O'M. Bockris [1966] 103 p refs
(Grant NsG-325)
(NASA-CR-77031) CFSTI: HC $4.00/MF $0.75 CSCL 07D

CONTENTS:

1. THE MECHANISMS OF VARIOUS TYPES OF HIGH RATE ELECTRODES p 1–5 (See N66-34188 20-06)
2. CATALYSIS OF SIMPLE ELECTRODE REACTIONS p 6–14 refs (See N66-34189 20-06)
3. POTENTIAL OF ZERO CHARGE p 15–27 refs (See N66-34190 20-06)
4. ADSORPTION IN THE DOUBLE LAYER WITH SPECIFIC REFERENCE TO THERMAL EFFECTS p 28–45 refs (See N66-34191 20-06)
5. ELECTRODE KINETIC ASPECTS OF ELECTROCHEMICAL ENERGY CONVERSION p 46
6. PUBLICATIONS UNDER GRANT NsG-325 p 47–48 refs

APPENDIX

7. THEORY OF POROUS GAS DIFFUSION ELECTRODES USING THE THIN FILM MODEL S. Srinivasan and H. D. Hurwitz p 49–85

N66-34188*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
THE MECHANISM OF VARIOUS TYPES OF HIGH RATE ELECTRODES
In its Studies in Fundamental Chem. of Fuel Cell Reactions [1966] p 1–5 (See N66-34187 20-06) CFSTI: HC $4.00/MF $0.75

Data from the computer solution of differential equations for the finite contact angle meniscus was analyzed and the graphs are presented for hydrogen and oxygen. The curves represent the half-current area dependence on applied potential and on tip potential. Electrodes were prepared by deposition of thin films on a supporting porous matrix. With catalyst loading of only 10 $\mu g/cm^2$ of Pt, Tafel behavior of oxygen reduction was followed up to currents of 100 ma/cm^2. N.E.N.

N66-34189*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
CATALYSIS OF SIMPLE ELECTRODE REACTIONS
In its Studies in Fundamental Chem. of Fuel Cell Reactions [1966] p 6–14 refs (See N66-34187 20-06) CFSTI: HC $4.00/MF $0.75

Coverage with oxygen containing species for various noble metals was reexamined and voltage–current data obtained for Au, Pt, Pd, Rh, and Ir electrodes at 12°, 27°, 35°, 45°, and 60°C. Coverage by oxygen containing species was found to change from one metal to another, to be dependent on the electrode potential, and to be little affected by the time an electrode is kept at a given potential. The I–V curves are the same as previously reported. It is concluded that all redox experiments on these metals were conducted on oxide free, bare metal electrodes. N.E.N.

N66-34190*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
POTENTIAL OF ZERO CHARGE *In its* Studies in Fundamental Chem. of Fuel Cell Reactions [1966] p 15–28 refs (See N66-34187 20-06) CFSTI: HC $4.00/MF $0.75

The effect of frequency and the concentration of the electrolyte on the capacitance on platinum electrode was studied in detail. The factors which can cause variation in capacitance with frequency are identified. Measurements were made at various potentials, increasing and decreasing the frequency from 500 to 8000 cps, and the results were plotted. It was concluded that the pseudocapacitance contribution to the measured frequency is negligible and the minimum capacitance corresponds to the potential of zero charge. In a second experiment to determine the effects of electrolyte concentration, measurements were carried out in dilute $HClO_4$ solution and with successive small additions of $KClO_4$. The plotted results show no indication of pseudocapacity due to ionization of H at these potentials, but do show that the minimum capacitance disappears at higher concentration and is thus characteristic of the maximum diffusivity of the double layer. N.E.N.

N66-34191*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
ADSORPTION IN THE DOUBLE LAYER WITH SPECIFIC REFERENCE TO THERMAL EFFECTS
In its Studies in Fundamental Chem. of Fuel Cell Reactions [1966] p 28–45 refs (See N66-34187 20-06) CFSTI: HC $4.00/MF $0.75

Adsorption measurements of benzene and ethylene by potential sweep method, and of benzene by galvanostatic transient methods were investigated. Time and temperature effects were emphasized. Modifications in the apparatus, and the calculation of the amount adsorbed by the potential sweep method are described. It was found that the results from a comparison of the radiotracer method and potential sweep method are still ambiguous. The agreement of results from the galvanostatic and potential sweep method was considered very good. N.E.N.

N66-34243# Western Ontario Univ., London. Dept. of Chemistry.
MERCAPTIDES OF COBALT, NICKEL, COPPER, AND ZINC
D. C. Bradley and C. H. Marsh 17 May 1966 6 p refs Submitted for Publication
(Contract Nonr-3325(00))
(TR-5; AD-633858) CFSTI: HC $1.00/MF $0.50

Preparations and certain properties are reported. TAB

N66-34250# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VERIFICATION OF THE SMOLUCHOWSKI EQUATION FOR VISCOUS SOLVENTS
James Hendrix Gorrell, Jr. (M.S. Thesis) Mar. 1966 115 p refs
(SP/PH/66-07; AD-633732) CFSTI: HC $4.00/MF $0.75

The experimental data needed to verify the applicability of the Smoluchowski equation in the calculation of the rate constant for donor to acceptor electronic energy transfer in n-hexadecane was obtained. This data was the quenching constant; the mean lifetime of the donor's excited state and the diffusion coefficients for donor and acceptor molecules in n-hexadecane. From the data obtained for three of the systems investigated, it was found that the Smoluchowski equation is a valid method for the calculation of the rate constant. For example, the experimental values of the rate constants for naphthalene, phenanthrene and chrysene were 12.1, 9.5, and 18.1×10^9 liter mole^{-1} second^{-1} as compared with the values 11.0, 12.5 and 16.7×10^9 liter mole^{-1} second^{-1} as calculated by means of the Smoluchowski equation. The values of the rate constants predicted by the Debye and Porter modifications of the Smoluchowski equation were 2.4 and 3.6×10^9 liter mole^{-1} second^{-1}, respectively.

Author (TAB)

N66-34258# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Materials Lab.

THERMAL STABILITY OF ORGANIC COMPOUNDS BY THE ISOTENISCOPE METHOD Summary Report, Dec. 1961–Jan. 1965

George Baum and Frank Short (Monsanto Res. Corp., Dayton, Ohio) May 1966 33 p refs Prepared Jointly with Monsanto Res. Corp.

(AFML-TR-65-347; AD-634782) CFSTI: HC $2.00/MF $0.50

The thermal stability of some 45 different organic compounds was determined by the isoteniscope method. A mechanistic interpretation of the data is used to discuss structure–stability relationships. Compounds which appear to possess a high degree of thermal stability are the fluorooxetanes, arylsilylamines, fluoroalkyltriazines, and fluoroaromatic compounds.

Author (TAB)

N66-34261# Ohio State Univ. Research Foundation, Columbus.

MOLECULAR STRUCTURE OF CARBANIONS AND THE KINETICS OF THEIR EXCHANGE PROCESSES IN SOLUTION Final Report, 1 Jan. 1963–30 Jun. 1965

Gideon Fraenkel and Don T. Dix Apr. 1966 40 p refs *Its* Rept.-1

(Grant AF-AFOSR-251-63)

(AFOSR-66-0879; AD-634108) CFSTI: HC $2.00/MF $0.50

Analysis of the results of changes among N.M.R. spectra of 2-methylbutylmagnesium bromide and bis(2-methylbutyl)-magnesium as a function of temperature in several ethers reveals that the changes are due to different rates of inversion at the CH_2Mg carbon atom. In diethyl ether the kinetic order of the inversion process is 2.5 in contained Grignard reagent, and enthalpy and entropy are 12 ± 0.5 kcal and -11 ± 2 e.u., respectively. For the organomagnesium compound, the order is 2.0, and enthalpy and entropy are 18 ± 0.5 kcal and 5 ± 2 e.u. Investigation is underway on the kinetics of the carbanion inversion in organo-lithium, -beryllium, and -aluminum compounds. Reaction between metals and hexamethyl phosphoramide indicate that the amide is reduced to tris-dimethylamino phosphine. Organometallic compounds are being synthesized from certain azo compounds, including RC(=O)N=Nr' and $RNHNH_2$.

TAB

N66-34264# Tyco Labs., Inc., Waltham, Mass.

ELECTROCHEMISTRY OF FUEL CELL ELECTRODES Final Technical Summary Report

A. I. Mlavsky 27 Apr. 1962 23 p refs

(Contract NObs-84770; ARPA Order 204-61)

(AD-634241) CFSTI: HC $2.60/MF $0.50

In an attempt to correlate electrode behavior with the electronic properties of electrode materials with incompletely occupied d-orbitals, a number of intermetallic compounds containing nickel together with an electronegative element from Groups IV-B, V-B, and VI-B of periodic tables, were synthesized and evaluated as electrode materials. NiO, NiS, NiAs, NiSb, NiSi and elemental nickel in the massive form have been studied in N_2, O_2 and H_2 atmospheres in both alkaline and acid perchlorate media. Anodic and cathodic polarization measurements were made. Polarization was pronounced at moderate current densities. Participation of O_2 and H_2 was poor and the corrosion reactions were prominent. The cathodic hydrogen evolution reaction on these electrodes is discussed. The use of palladium as a support material for quick permeation of hydrogen and avoiding the three-phase interface problem is discussed. Results of the effect of various treatment of the palladium surface on the permeation of hydrogen are presented and discussed.

Author (TAB)

N66-34279# Illinois Univ., Urbana. Noyes Chemical Lab.

HIGH TEMPERATURE GAS KINETIC STUDY OF NITROUS OXIDE DECOMPOSITION PERFORMED WITH A SHOCK TUBE AND QUADRUPOLE MASS-FILTER Research Report No. 2

David Gutman May 1965 91 p refs

(Grants AF-AFOSR-62-245; AF-AFOSR-588-64)

(AFOSR-66-0952; AD-634399) CFSTI: HC $3.00/MF $0.75

A quadrupole mass-filter was built and coupled to a shock tube in order to study high temperature gas kinetics. The chemical kinetics of the decomposition of nitrous oxide was studied with this apparatus in order to establish the mechanism of the reaction at temperatures above 1000°K. Several instrumentation problems unique to shock tube mass-spectrometry were solved. The most serious problem, that of a rapid-pumping ion source, was overcome by the design and construction of an unusually thin ion source. The thermal decomposition of nitrous oxide was studied by shock-heating a mixture of 4% N_2O in argon and monitoring the ion currents corresponding to all of the principal species involved in the reaction: N_2O, N_2, O_2, NO, and O. In each run with the shock tube, the mass-filter was tuned to follow the concentration of a single species, because enough runs were made with all of the species. A run for each species at the same temperature was made for several temperatures.

Author (TAB)

N66-34286# Coating and Chemical Lab., Aberdeen Proving Ground, Md.

THE ENERGETICS OF SURFACTANT ADSORPTION AT THE AIR-WATER INTERFACE

A. Mankowich May 1966 27 p refs

(CCL-201; AD-634317) CFSTI: HC $1.00/MF $0.50

The standard free energy, enthalpy, and entropy changes (ΔG, ΔH, and ΔS, respectively) for the adsorption at the air–water interface of a commercial ethylene oxide (EO) adduct of straight chain nonylphenol from monomer solution at the critical micelle concentration (CMC) were calculated from surface tension-concentration data at 21–45°C using the Gibbs equation, the standard free energy change equation $\Delta G = -RT\ln$ (interfacial monomer concentration/CMC), and the Gibbs–Helmholtz equation which gave ΔH directly from the slope of the $(\Delta G/T)$ vs $(1/T)$ function. The CMC and surface tension at the CMC (γ-CMC) decreased, and $-\Delta G$ and molecular area increased slightly, with increasing temperature. The ΔH and ΔS values were positive, and appear explainable by

the postulations applied to micellization. At ambient temperature (28°C) an increase in the (EO) mol ratio of straight chain nonylphenol and C_{13} secondary alcohol etoxylates resulted in increases of CMC, γ-CMC, and molecular area, and slight decreases in $-\Delta G$. A comparison of the 9(EO) mol ratio adducts of C_{13} straight chain primary and secondary alcohols showed that the CMC and molecular area of the secondary alcohol ethoxylate were larger, and the γ-CMC and $-\Delta G$ smaller than the corresponding values of the primary alcohol ethoxylate. Author

N66-34308# Library of Congress, Washington, D. C. Aerospace Technology Div.

DEVELOPMENT OF POLYARYL ESTERS IN THE USSR

Boris Ofrossimow *In its* Foreign Sci. Bull., Vol. 2, No. 7 Jul. 1966 p 19–33 refs (See N66-34306 20-34)

Soviet literature on the mechanical properties, heat resistance, and thermal stability of polyaryl esters is reviewed. Such esters are called polyarylates (PA) by the Soviets, and two development trends for them are listed: (1) cross-linking of unsaturated PA with unsaturated monomers, and (2) preparation of inherently colored heat-resistant PA materials with good mechanical properties. Tabulated data cover: modification of PA properties by the introduction of reactive groups, effect of substituents at the central carbon atom of the bisphenol on the PA properties, effect of morphological forms on the mechanical properties of PA, and degradation and cross-linking of PA. Designations and types of PA are included. R.Ll.

N66-34326*# Mellon Inst., Pittsburgh, Pa.

PHYSICAL PROPERTIES OF AROMATIC HYDROCARBONS. PART II: SOLIDIFICATION BEHAVIOR OF 1:3:5 TRI-α-NAPHTHYLBENZENE

J. H. Magill and D. J. Plazek [1965] 52 p refs

(Grant NsG-147)

(NASA-CR-77301) CFSTI: HC $2.50/MF $0.50 CSCL 07C

The kinetics of solidification of 1:3:5 tri-α-naphthylbenzene have been studied from 25° above the glass temperature (69°C) almost to the crystal thermodynamic melting point (199°C). The crystal growth rate has been analyzed using current theories of crystallization and a mechanism for crystal growth has been proposed. It has been demonstrated that mass transport in crystal growth and viscous flow do not have the same temperature dependence. The morphology of the solid phase is discussed. Pertinent parameters pertaining to the glassy state of this material are also reported. Author

N66-34374*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

KINETICS OF THE FLUORINATION OF IRON

Patricia M. O'Donnell Washington, NASA, Aug. 1966 14 p refs

(NASA-TN-D-3575) CFSTI: HC $1.00/MF $0.50 CSCL 07B

The effect of temperature and pressure on the reaction of fluorine gas on solid iron samples was studied at various pressures up to 200 torr over the temperature range of 225°C to 525°C. An activation energy of 2 kilocalories was calculated for the 60-torr pressure runs. The reaction was found to follow the logarithmic rate law, and logarithmic rate constants are reported. The probable mechanism of film growth is movement of fluorine through defects in the fluoride film to the iron surface. Author

N66-34376*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESORPTION KINETICS OF MULTIPLE ADSORBATES—CESIUM WITH FLUORINE ON MOLYBDENUM AND TUNGSTEN

Leonard K. Tower Washington, NASA, Aug. 1966 37 p refs

(NASA-TN-D-3596) CFSTI: HC $2.00/MF $0.50 CSCL 07B

Thermionic diodes containing multiple additives have received attention because of the increased durability of the surface layers and their low work functions. In the present report, the factors responsible for the enhanced durability of the multiple coating are examined. Activation energies for desorption of cesium from fluorinated molybdenum and fluorinated tungsten are deduced from experimental data. The fluorine serves to increase the activation energy for desorption of cesium from the surface. The energies for desorption of cesium from fluorinated molybdenum and fluorinated tungsten at low cesium coverages were found to be similar to the dissociation energy of the cesium fluoride molecule. Activation energies for the desorption of fluorine from tungsten and from molybdenum are also computed from published experimental data. A simple means of predicting these quantities for halogens on a variety of substrates is discussed, and values are presented. Hafnium and tantalum may bind the halogen layers more tightly than other refractory metals, with osmium binding more weakly. These contrasting properties may prove of value in construction of power-producing thermionic devices. Author

N66-34429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTROLYTE SOLVENT PROPERTIES OF ORGANIC SULFUR DERIVATIVES

Richard E. Johnson Washington, NASA, Aug. 1966 16 p refs

(NASA-TM-X-1283) CFSTI: HC $1.00/MF $0.50 CSCL 07C

A screening investigation was conducted to determine the potentialities of organic aliphatic and aromatic sulfur derivatives as solvents for high-energy-density batteries. Side tests included the testing of various other organic compounds to obtain data for comparison with the sulfur derivatives. A literature survey was also made of phosphorus and arsenic organic compounds, but only one experiment was performed because of the high chemical reactivity of these chemicals. Propylene glycol sulfite had the best electrochemical properties. All the promising sulfur derivatives contained the -SO or the $-SO_2$ radical. The investigations were limited to those solvents which have a liquidus range similar to that of water (0° to 100°C) and which are readily available from commercial suppliers. Author

N66-34480# Western Ontario Univ., London. Dept. of Chemistry.

METAL MERCAPTIDES. PART I: TITANIUM TETRAMERCAPTIDES AND DIALKYLAMINOTITANIUM (IV) MERCAPTIDES

D. C. Bradley and P. A. Hammersley 16 May 1966 25 p refs Submitted for Publication

(Contract Nonr-3325(00))

(TR-4; AD-633857) CFSTI: HC $1.00/MF $0.50

Reactions of excess mercaptan R'SH (R'=Me, Et, or Pr^i) with titanium dialkylamides $Ti(NR_2)_4$ (R=Me or Et) gave insoluble non-volatile red titanium tetramercaptides containing strongly addended mercaptan and amine, *viz.* $Ti(SR')_4.(R'SH)_x(R_2NH)_y$. It is suggested that these compounds are polymeric due to mercaptide bridges and that 8-coordinated titanium may be involved. Soluble complexes of the type $Ti(SR')_4.(R_2NH)_x$ where R'=Pr^n or Bu^n, were also obtained.

Attempts to prepare titanium tetratert.-butylmercaptide gave products believed to be titanium sulphide tert.-butylmercaptides which on heating gave impure titanium sulphide. Controlled addition of ethylmercaptan or isopropylmercaptan to $Ti(NR_2)_4$ gave soluble compounds: $Ti(NMe_2)_3SEt$, $Ti(NMe_2)_2(SEt)_2$, $Ti(NMe_2)_3SPr$ and $Ti(NMe_2)_2(SPr)_2$ which were shown by cryoscopic measurements to be polymeric. Infrared and n.m.r. spectra were also obtained. Author (TAB)

N66-34517# Mithras, Inc., Cambridge, Mass.
A WIND TUNNEL INVESTIGATION OF THE NITRIC OXIDE–OXYGEN ATOM REACTION Final Report, 1 Jan.–30 Nov. 1965
R. Earl Good and Jacques A. F. Hill Mar. 1966 72 p refs
(Contract AF 19(628)-4959)
(MC-64-116-R1; AFCRL-66-284; AD-634312) CFSTI: HC $3.00/MF $0.75

The technique of upper atmosphere measurements by analyzing the chemiluminescence of nitric oxide trails deposited by rockets was investigated using wind tunnel simulation. The nitric oxide was released from a model into the low density tunnel flow which had been partially dissociated upstream of the plenum chamber by microwave discharge, the radiant power produced was measured separately by photographic and photoelectric techniques under controlled nitric oxide and atomic oxygen concentration flow rates. The tests were conducted at Mach number 3.4 and at freestream pressures between 1 and 10 microns Hg, the geometric shape of the radiating mixing layer contained between two shockwaves was observed and described in terms of the flow rates. The chemiluminescent NO + O to NO_2 + photon-reaction rate measured by two independent techniques was found to be $k = 3(\pm 2) \times 10^{-12}$ cm^3 $molecules^{-1}$ $seconds^{-1}$. Scaling laws were developed to relate the radiant power to the concentration flow rates, these scaling laws were then used to determine the absolute oxygen concentrations in the upper atmosphere from previously conducted flight experiments. Excellent agreement was obtained between the densities obtained by the nitric oxide release technique and mass spectrometer measurements. Author (TAB)

N66-34531# Research Triangle Inst., Durham, N. C. Natural Products Lab.
THE PREPARATION OF SMALL RING COMPOUNDS CONTAINING SILICON. PART I: VINYL-HYDROGEN LIGAND EXCHANGE ON SILICON. PART II: THE PREPARATION AND ISOMERIZATION OF MONOCYCLIC SILYLHYDRAZINES. PART III: ON THE ATTEMPTED SYNTHESIS OF THE 1, 2-DISILACYCLOBUTANE RING SYSTEM Technical Report, Jun. 1965–Jun. 1966
Colin G. Pitt, Kenneth R. Skillern and Glenn L. Roof Jun. 1966 29 p refs
(Contract Nonr-4860(00))
(TR-1; AD-634735) CFSTI: HC $2.00/MF $0.50

The first example of vinyl-hydrogen ligand exchange at silicon, catalyzed by chloroplatinic acid, is described. The disproportionation of tri-p-tolylsilane to di-p-tolylsilane and tetra-p-tolylsilane is shown to occur without isomerization to ortho, meta, or benzyl isomers. The aluminum chloride catalyzed fragmentation of bis-1,2-(dimethylchlorosilyl) ethane and 1-triethylsilyl-2-dimethylchlorosilyethane is reported. The preparation of 3,3,6,6-tetramethyl-1,2-diaza-3,6-disilacyclohexane and 1-amino-2,2,5,5-tetramethyl-1-aza-2,5-disilacyclopentane is described. The two compounds are shown to be in equilibrium at room temperature even in the absence of catalysts. 1,2-bis(trimethylsilyl)hydrazine is shown to be in equilibrium with 1,1-bis(trimethylsilyl)hydrazine, although thermal equilibration is relatively slow. The preparation of the 1,2-disilacyclobutane ringing system was attempted by: (1) ring closure of bis-1,1-(chlorosilyl)ethanes with various metals and (2) oxidation of 3,3,6,6-tetramethyl-1,2-diaza-3,6-disilacyclohexane and 1-amino-2,2,5,5-tetramethyl-1-aza-2,5-disilacyclopentane with mercuric oxide and ethyl azodicarboxylate. The products obtained from these oxidations have been characterized and their formation discussed. Author (TAB)

N66-34558# Canrad Precision Industries, Inc., Chicago, Ill. Sampson Chemical and Pigment Div.
FEASIBILITY STUDY RELATING TO THE DEVELOPMENT OF A NEW HYDROGEN-3 (TRITIUM) ACTIVATED SELF-LUMINOUS COMPOUND Final Report
S. Isenberg, I. Feuer, W. Goldman, and O. Strongin [1962] 24 p refs
(Contract DA-44-009-ENG-5259)
(AD-635127) CFSTI: HC $1.50/MF $0.50

Research studies directed towards the development of a self-luminous paint activated by H-3 (tritium) are reported. The results obtained indicate that it is definitely feasible and practicable to incorporate tritium with the structural framework of a zinc sulfide phosphor by means of a carrier agent such as a hydride-forming component. TAB

N66-34575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACCURACY OF THREE METHODS FOR DETERMINATION OF OXYGEN IN POTASSIUM AT CONCENTRATIONS LESS THAN 20 PARTS PER MILLION
Randall F. Gahn and Louis Rosenblum Washington, NASA, Aug. 1966 18 p refs
(NASA-TN-D-3239) CFSTI: HC $1.00/MF $0.50 CSCL 07B

In order to assess the accuracy of the vacuum amalgamation, vacuum distillation, and neutron activation methods in the determination of oxygen in potassium at concentrations less than 20 parts per million, a number of comparative analyses were made on four different batches of potassium by a replicate sampling technique. The environmental contamination pickup for the vacuum amalgamation and vacuum distillation methods, as a function of the pressure in the analytical system, was found to be 400 and 270 milligrams of oxygen per torr, respectively, independent of sample size. The method blanks were found to be 3.1 and 2.8 micrograms of oxygen, respectively. Agreement between vacuum distillation and vacuum amalgamation mean oxygen values (corrected for systematic errors) in all cases was within 2 parts per million. The overall standard deviations of the vacuum distillation and vacuum amalgamation methods were 4.3 and 3.1 parts per million, respectively. The effect of alkaline impurities on the analytical results of the neutron activation and amalgamation (or distillation) methods was calculated. When adjusted for the effect of alkaline impurities and systematic errors, oxygen values for all three methods showed good agreement. Author

N66-34595# Georgia Univ., Athens. Dept. of Chemistry.
A THERMODYNAMIC STABILITY SCALE FOR STABLE, ISOLABLE FREE RADICALS Final Scientific Report, 1 Oct. 1961–31 Mar. 1966
Robert C. Lamb and Carroll T. Clark [1966] 12 p refs
(Grants AF-AFOSR-62-53; AF-AFOSR-543-64)
(AFOSR-66-1409; AD-635103) CFSTI: HC $1.00/MF $0.50

A summary is given of studies involving the establishment of a stability scale for certain galvinoxyl derivatives, and the use of stable free radicals as scavengers of radicals formed in decompositions of free radicals initiators. The publications resulting from this work are listed. TAB

N68-34601# Mississippi Univ., University.
TRANSLATION TO VIBRATION TRANSITION PROBABILITIES IN CO_2-H_2 AND C_2-He COLLISIONS
James W. L. Lewis and F. Douglas Shields 1 Jul. 1965 39 p refs
(Contract Nonr-3078(01))
(AD-635097) CFSTI: HC $2.00/MF $0.50

The probability of a collision transferring energy from translation to vibration generally increases with relative speeds with which the molecules collide. Measured transition probabilities, therefore, generally increase with temperature. Some years ago this expected temperature effect was observed to fail for CO_2-H_2O, CO_2-H_2 and CO_2-He collisions. Widom and Bauer proposed an explanation for the first of these in terms of a chemical affinity between the CO_2 and H_2O molecules but their theoretical results were in disagreement with the experimental values available at the time. Recent experimental results have brought measured values more nearly in line with the Widom–Bauer calculations. This paper describes similar calculations for the CO_2-H_2 system and reports experimental results that indicate the collision efficiency for CO_2-He increases normally with temperature. Author (TAB)

N68-34614# IIT Research Inst., Chicago, Ill.
RESEARCH ON CHEMISTRY OF O_3F_2 AND O_2F_2 Annual Summary Report, Jan. 1–Dec. 31, 1965
Irvine J. Solomon 18 Mar. 1966 56 p refs
(Contract AF 49(638)-1175)
(IITRI-C227-14; AFOSR-66-0953; AD-634440) CFSTI: HC $3.00/MF $0.50

The reactions of HNF_2 with $(CH_3)_3$ Al and with B_2F_4 and O_2F_2 with SO_2 and with NO_2 were studied. The product of the reaction of HNF_2 with $(CH_3)_3$ Al was examined by low-temperature infrared spectroscopy. The initial product is believed to be a coordination compound, HNF_2-Al$(CH_3)_3$, which decomposes at −80°C and above to form $(CH_3)_2AlNF_2$. The infrared spectra were consistent with this supposition. No nuclear magnetic resonance spectrum could be obtained for $(CH_3)_2$ $AlNF_2$ because of either poor solubility (in CH_2Cl_2) or polymerization. In the $HNF_2-B_2F_4$ system, negative deviations from ideality were observed, although a stable adduct could not be isolated. Several unexplained explosions occurred during the handling of this mixture. The reaction of SO_2 with O_2F_2 produced in addition to SO_2F_2, interesting minor products, FSO_2OF and FSO_2 OOF. The mechanism of the formation of these products was studied by the use of O^{17} labeled SO_2 and O_2F_2 and by O^{17} NMR analysis of the products. The reactions of SO_2 with FSO_2OF and FSO_2OOF were studied; $F_2S_2O_6$ was produced in both cases. The reactions of NO_2 with O_2F_2 were studied. FNO_3 was not formed, but only simple fluorination occurred, resulting in FNO_2. The products of the reaction of O_3F_2 with SO_2 were essentially the same as those obtained with O_2F_2, except that the relative quantities were different. TAB

N68-34629*# California Univ., Berkeley. Space Sciences Lab.
HIGH RESOLUTION MASS SPECTROMETRY IN MOLECULAR STRUCTURE AND STEREOCHEMICAL STUDIES; EFFECT OF STEREOCHEMISTRY ON THE FRAGMENTATION OF EPIMERIC DERIVATIVES OF AZABICYCLOALKANES
D. H. Smith, H. K. Schnoes, and A. L. Burlingame [1966] 11 p refs Submitted for Publication
(Grant NsG-101)
(NASA-CR-77309) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Studies were conducted to verify an earlier examination of possible correlations that might be drawn between the low resolution mass spectra and the structures and stereochemistry of a series of related azabicycloalkanes. High resolution mass spectra of representative members of the series were determined. Subsequent data acquisition and reduction verified the compositions of the peaks earlier reported and assisted in elucidating certain features of the fragmentation patterns of epimeric pairs. The results of this study showed that the M-1 peak is larger for the epimer with a larger substituent oriented toward nitrogen; fragmentation proceeds with loss of the substituent oriented toward nitrogen to yield a C/H N fragment ion in the β-epimers or a C/H N O fragmentation for the α-epimers; and other differences in the C/H N and C/H N O data plots may be explained by the loss of an appropriate aliphatic radical. Additional results are assessed and the data plots obtained are shown. H.S.W.

N68-34654# Bureau of Mines, Minneapolis, Minn. Metallurgy Research Center.
REACTION INTERFACE SPEED AS A REDUCIBILITY INDEX FOR IRON ORE
John Paul Hansen, T. N. Rushton and Clifford W. Schutz 1966 42 p refs
(BM-RI-6827)

Reducibility tests were run on an open hearth lump ore and four groups of pellets whose smelting characteristics had been determined previously in the experimental blast furnace. When reduction data from various tests were plotted on specially prepared paper 1-(1-percent reduction/100)$^{1/3}$ against time, the plots were linear. The iron-wustite interface therefore advances at a constant rate. The rate of the interface advance in mm/min was used as a reducibility index. The reducibility index measured at 900°C, using 0.45 cu ft hydrogen per minute varied inversely with the surface area of the sample. Even with carefully controlled surface areas, however, duplicate reducibility indices varied considerably. When enough tests were run to give a stable mean, the mean reducibility index did correlate with blast furnace production for the four pellet groups. Results indicated that if the interface speed itself were to be used for correlation with blast furnace production, a sample size of about 180 grams of minus 0.742-plus 0.525-inch particles should be used with a test temperature of 900°C and a flow of 0.45 cu ft hydrogen per minute. Author

N68-34749# National Lead Co. of Ohio, Cincinnati.
COMPARISON OF ANALYTICAL PROCEDURES FOR QUANTITATIVE MICROPROBE ANALYSIS
J. W. Colby 29 Oct. 1965 26 p refs Presented at the Eastern Anal. Symp., New York, 18 Nov. 1965
(Contract AT(30-1)-1156)
(NLCO-969; CONF-651115-1) CFSTI: HC $2.00/MF $0.50

Several well-known techniques for correcting raw microprobe data are discussed and are subjected to analytical testing. It was found that although most of the correction procedures work fairly well for some systems, they work poorly for others. However, by judiciously choosing analytical conditions, and by employing a correction procedure appropriate to the system being analyzed and the analytical conditions employed, good results can nearly always be obtained. Author (NSA)

N68-34787# Cornell Univ., Ithaca, N. Y.
THE SILVER CHLORIDE-AQUEOUS SOLUTION INTERFACE
Charles Archibald Steidel (Ph.D. Thesis) Feb. 1966 116 p refs
(Contract AT(30-1)-3228)
(NYO-3228-5) CFSTI: HC $4.00/MF $0.75

Extensions were made to the Grimley–Mott theory for the silver halide-solution interface to include lattice impurities and also the molecular condenser. Although, direct evidence of the existence of a space charge in the solid was found, its significance was not found. A new technique of transient potential measurements and qualitatively, the a–c conductance measurements, provided reasonable evidence for the existence and importance of the space charge in the solid; further the isoelectric point for macroscopic silver chloride crystals was found to agree with that observed in colloidal systems. Transient potential measurements also provided direct evidence for the existence of the entire theoretical potential, λ, at the interface, and d–c conductance measurements indicated a correlation between the isoelectric point and the conductance minimum. NSA

N66-34764# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).

ON THE PURIFICATION OF ELEMENTARY FLUORINE AND ITS FILLING IN STEEL CYLINDERS [UEBER DAS REINIGEN DES ELEMENTAREN FLUORS UND DESSEN EINFUELLEN IN STAHLFLASCHEN]

J. Slivnik, A. Smalc, and A. Zemljic Jan. 1965 8 p refs In GERMAN

(NIJS-R-446)

An apparatus for the purification and the introduction of elementary fluorine into steel cylinders using the liquefaction method is described. The inflow of the fluorine into the liquid holder was regulated by a magnetic valve that is controlled by a specially constructed contact manometer. Author (NSA)

N66-34779# McMaster Univ., Hamilton (Ontario). Dept. of Metallurgy and Metallurgical Engineering.

DISSOLUTION SPIRALS ON GAMMA-IRRADIATED LITHIUM FLUORIDE

M. B. Ives and T. R. Ramachandran Jun. 1966 19 p refs

(Contract Nonr-3925(00))

(TR-6; AD-634746) CFSTI: HC $1.00/MF $0.50

Double-spiral features have been observed at high resolution on lithium fluoride (100) surfaces etched in distilled water containing from 0.1 to 9 ppm ferric ions (as ferric chloride). The models proposed for similar features on other materials are reviewed and rejected in favour of a mechanism involving the formation of prismatic loops produced by vacancy condensation following gamma-irradiation. In preference to the existence of dislocations in lithium fluoride with large Burgers vector, a series of 'stacked' loops is suggested. Author (TAB)

N66-34782# Army Foreign Science and Technology Center, Washington, D. C.

PRIMERS AND EXPLOSIVES

Jun. 1966 19 p refs Transl. into ENGLISH from Vzryvnoye Delo (USSR), no. 55, Dec. 1964 p 93–97, 132-39

(FSTC-HT-23-110-66; AD-634414) CFSTI: HC $1.00/MF $0.50

Three papers describe methods for determining the detonating capacity of primers, the detonation characteristics of certain nitroglycerine explosives, and the properties of several new Soviet explosives used in mining and blasting operations. Graphical data on detonation velocities are presented and tabular information is given on the performance of various explosives developed in recent years. Author (TAB)

N66-34815# American Cyanamid Co., Stamford, Conn. Central Research Div.

CHEMILUMINESCENT MATERIALS Technical Report No. 12, Mar. 1–May 31, 1966

M. M. Rauhut et al 30 Jun. 1966 117 p refs

(Contract Nonr-4200(00); ARPA Order 299)

(Rept.-66-1432-Q12; AD-635142) CFSTI: HC $4.00/MF $0.75

Current results of a program designed to provide efficient peroxyoxalate chemiluminescent systems are described. The synthesis and chemiluminescent properties of a number of new chemiluminescent oxalate esters and amides are reported. Reaction condition studies relating to the effects of reactant concentrations and the effects of certain additives are discussed. The qualitative chemiluminescence efficiencies of a large number of fluorescers are summarized. Author (TAB)

N66-34816# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

A STUDY OF X-RAY ABSORPTION EDGE SPECTROSCOPY AS A TOOL FOR SOLID-STATE CHEMICAL RESEARCH Final Technical Report

Armand J. Panson 31 Jan. 1966 38 p refs

(Contract Nonr-4463(00))

(AD-635174) CFSTI: HC $2.00/MF $0.50

Progress in the following areas is reported (the first 3 items are summarized briefly—a detailed report having been given in AD-610 719): (1) design and development of a novel monitored beam X-ray absorption spectrometer arrangement to solve the intensity stabilization problem, (2) observation of covalency effects in the spectrum of several copper compounds, (3) investigation of valence changes associated with conductance and magnetic anomalies in Iac003, (4) a study of the sensitivity of absorption edge position to valence in a series of iron compounds, (5) investigation of the tetravalent oxidation state of iron, (6) investigation of 'white-line' spectra in some cyanides and study of relative intensity fluctuations with bonding 'p' character. Author (TAB)

N66-34867# Rocket Propulsion Establishment, Westcott (England).

THE DISSOCIATION ENERGY OF THE N–H BOND IN HYDRAZINE AND RELATED COMPOUNDS

I. P. Fisher London, Min. of Aviation, Dec. 1965 22 p refs (RPE-TR-65/11; AD-634219) CFSTI: HC $1.00/MF $0.50

There are, currently, two values proposed for the N–H bond dissociation energy in hydrazine. Arguments are presented in favor of the lower value. Bond strengths, heats of formation and ionization potentials of radicals related to the hydrazyl radical are derived. Author (TAB)

N66-34913# Office of Naval Intelligence, Washington, D. C. Translation Section.

KINETICS OF IONIZATION OF OXYGEN [KINETIKA IONIZATSII KISLORODA]

A. I. Krasilvchikov et al [1953] 9 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 27, no. 3, 1953 p 389–393 (ONI-TRANS-2150; AD-634298) CFSTI: HC $1.10/MF $0.50

Ionization of oxygen on a nickel electrode in alkali was investigated under pressure. The phenomenon of 'cathode passivity' of nickel relative to the process of reduction of oxygen is described. Ionization of oxygen on smooth platinum in acid and alkaline solutions was investigated. The high sensitivity of the process to various types of poisoning is shown. A kinetic scheme for the reduction of oxygen on an activated smooth platinum electrode is proposed. Kinetic

schemes for the reduction of oxygen on platinum and silver are compared. The effect of the forming radicals on the process of cathode reduction of oxygen is discussed. Author (TAB)

N66-34948# Army Natick Labs., Mass. Clothing and Organic Materials Div.

RESEARCH COMPOUNDING OF NITROSO RUBBER TERPOLYMERS Technical Report, Oct. 1964–Dec. 1965

Charles B. Griffis and Charles W. Shuftleff May 1966 21 p ref (TR-66-42-CM; AD-635114) CFSTI: HC $4.00/MF $0.50

Terpolymers were synthesized to give nitroso rubbers having improved processing characteristics and improved low-temperature properties. The terpolymers fall into six types: aromatic-containing, bromine- or chlorine-containing, hydrogen-containing, diene-containing, ester-containing, and miscellaneous. Processing studies were conducted based on the reactive chemical sites contained in the terpolymer. Low-temperature property studies were confined to differential thermal analysis determinations of the second-order transition, Tg, temperatures. The best processing results were obtained with dichlorobenzoyl peroxide crosslinked esters. The low-temperature properties of the terpolymers show promise for an improved processible nitroso rubber. Author (TAB)

N66-34962# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Materials Lab.

COBALT-60 RADIOLYSIS OF SOLID ETHYL IODIDE Technical Report, Sep. 1964–Apr. 1965

G. L. Hermann and L. A. Harrah Apr. 1966 32 p refs (AFML-TR-65-333; AD-634912) CFSTI: HC $2.00/MF $0.50

Glass and polycrystalline ethyl iodide at 77°K were irradiated with cobalt 60. Yields of free radicals were measured with an electron paramagnetic resonance spectrometer. G values for radicals in glass and polycrystalline phases were 1.53 and 0.33. Hydrocarbon reaction products were separated by Toepler pumping and measured with a mass spectrometer, products containing iodine were measured by spectrophotometric methods. Ethene–ethane and hydrogen iodide–iodine product ratios were much higher in the polycrystalline phase than in the glass phase, and higher in the glass phase than in previous results from the liquid phase. Author (TAB)

N66-34982# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.

THE CHEMICAL EFFECTS OF IRRADIATED TRIPLE-BOND COMPOUNDS Final Report, Mar. 1962–Dec. 1965

Roger E. Rondeau and Larry A. Harrah Apr. 1966 58 p refs (AFML-TR-66-33; AD-634859) CFSTI: HC $3.00/MF $0.75

The radiation chemistry of acetonitrile, propionitrile, and fifteen alkynes was studied using three different experimental approaches: product analysis (PA), electron spin resonance spectrometry (ESR), and mass spectrometry (MS). The results of each study are discussed in terms of reactions proceeding through energetic intermediates. The ESR and MS studies discuss the intermediates responsible for the product distribution found in the PA study. Topics of discussion include phase effects, extent of hydrogen evolution, toxic product yields, cyclization reactions, induced polymerization, and radiation protection. Author (TAB)

N66-35024# Joint Publications Research Service, Washington, D. C.

NUCLEAR CHEMISTRY

V. I. Gol'danskiy and A. K. Lavrukhina, ed. 11 Aug. 1966 455 p refs Transl. into ENGLISH of the book "Yadernaya Khimiya" Moscow, 1965 p 3–329
(JPRS-36943; TT-66-33373) CFSTI: $7.50

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10. RESTORATION OF THE PULSE DISTRIBUTION OF ANNIHILATING ELECTRON–POSITRON PAIRS BY ANGULAR CORRELATION OF GAMMA-QUANTA P. U. Arifov, V. I. Gol'danskiy, and Yu. S. Soyasov p 335–343 refs

11. USE OF THE HARTREE–FOK METHOD IN PROBLEMS OF THE ANNIHILATION IN CONDENSED MEDIA OF THE IONIC TYPE V. I. Gol'danskiy, A. V. Ivanova, and Ye. P. Prokop'yev p 344–368 refs

12. USE OF THE MOSSBAUER EFFECT IN THE SOLUTION OF PROBLEMS OF CHEMISTRY AND GEOCHEMISTRY T. V. Malysheva p 369–387 refs

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14. CAPTURE OF POSITRONS BY DEFECTS IN ALKALI–HALOGEN CRYSTALS V. I. Gol'danskiy and Ye. P. Prokop'yev p 399–408 refs

15. POSSIBILITIES OF THE METHOD OF MOLECULAR NEUTRONOSCOPY G. K. Ivanov and Yu. S. Sayasov p 409–421 refs

16. PROBLEMS OF THE PHYSICS AND CHEMISTRY OF MUONIUM V. G. Nosov p 422–436 refs

17. METHOD OF STUDYING THE MECHANISM AND PARAMETERS OF CHEMICAL REACTIONS BY DEPOLARIZATION OF μ^+-MESONS V. G. Firsov and V. M. Byakov p 437–455 refs

N66-35026# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.

THEORETICAL AND QUANTUM CHEMISTRY OF N, O, F COMPOUNDS Quarterly Technical Report, 9 Jan.–9 Apr. 1966

Joyce J. Kaufman [1966] 7 p
(Contract DA-31-124-ARO(D)-203; ARPA Order 542)
(QTR-8; AD-633392) CFSTI: HC $1.00/MF $0.50

Rigorous LCAO–MO–SCF calculations: A new atomic SCF program based on 'Combined Gaussian-type orbitals (CGTO)' is being coded. This is to supply many-center molecular SCF programs with basis functions which should enjoy excellent performance competitive with good STO basis functions. Semi-empirical LCAO–MO calculations; disagreement was expressed with the pattern of dissociation energies reported at the meeting of the working group in the thermochemistry of propulsion compounds held in Cape Kennedy, Florida. The reason is that investigations for OF or NF compounds show the calculated overlap populations to be in the same order as the experimental bond dissociation energies, with both of them consistent with observed infrared stretching frequencies. TAB

N66-35052*# Weizmann Inst. of Science, Rehovoth (Israel).
MECHANOCHEMISTRY OF COUPLED CONTRACTILE AND CHEMICAL RATE PROCESSES Final Report, 1 Jan. 1964–31 Dec. 1965
A. Katchalsky [1965] 67 p refs
(Grant AF-EOAR-64-25)
(AFOSR-66-1181; AD-635032) CFSTI: HC $3.00/MF $0.75 CSCL 07D

Contents: summary of work under the contract; chemomechanical and mechanochemical transformations (abstract); mechanochemical engines; measurements on power and efficiency of a mechanochemical engine; the equation of state of chemically molten collagen fibers (abstract); changes in the infrared absorption spectrum of collagen due to the interaction with LiBr; an X-ray investigation of the mechanochemical melting of collagen (abstract); the relation between force and rate of contraction in collagen fibers in the presence of contractile salt; the vibrating reed technique. (TAB)

N66-35069# Mississippi Univ., University.
MULTIPLE VIBRATIONAL RELAXATION IN GASEOUS SULFUR DIOXIDE
F. D. Shields 1 Jul. 1966 25 p refs
(Contract Nonr-3078(01))
(AD-635098) CFSTI: HC $1.00/MF $0.50

Sound absorption and velocity measurements have been made in pure SO_2 and mixtures of 25 and 50% Ar with SO_2 at room temperature, 400°K and 500°K. The results confirm earlier reports of a multiple relaxation process. The data has been fit with both series and parallel relaxation curves and the temperature dependence of the individual relaxation times determined. The difficulty in distinguishing between the two processes is discussed. Author (TAB)

N66-35083# Tulane Univ., New Orleans, La. Dept. of Chemistry.
PHOTOCHEMISTRY OF UNSATURATED CARBONYL DERIVATIVES AND RELATED SMALL RING SYSTEMS Final Report, Jul. 1, 1963–Dec. 31, 1965
Gary W. Griffin 1 Jun. 1966 29 p refs
(Grant DA-31-124-ARO(D)-130)
(AROD-4375-11; AD-635217) CFSTI: HC $4.00/MF $0.50

The photofragmentation of a variety of small ring homo- and heterocyclic systems including cyclopropanes, epoxides, aziridines, oxaziranes and episulfides were studied. The photoarrangement of cyclopropenes to olefins and the photoinduced conversion of cyclopropenes to indenes were also examined. The studies are complementary and those parameters which determine the reaction course are defined in each case. For example, it is of interest to determine why certain cyclopropanes fragment to carbenes and others simply rearrange to isomeric olefins. Many of those reactions described have synthetic utility and heretofore inaccessible systems were synthesized. The photo-fragmentation of stilbene oxide is illustrative and appears to be the method of choice for preparing phenylcarbenes and thus phenylcyclopropanes and cyclopropenes. Author (TAB)

N66-35127# Joint Publications Research Service, Washington, D. C.
THE CHEMISTRY OF BERYLLIDES
G. V. Samsonov 25 Aug. 1966 65 p refs Transl. into ENGLISH from Usp. Khim. (Moscow), v. 35, no. 5, 1966 p 779–822
(JPRS-37222; TT-66-33651) CFSTI: $3.00

This survey contains various studies and characteristic diagrams of the properties of beryllium containing metals. Topics include the crystalline structures of numerous beryllide phases; some of their chemical, physical, and technical parameters; and information on their chrystallochemistry, electron structure, and chemical bonding. The high strength of beryllides of the transition metals at high temperatures, about 10 times as high as the strength of ceramics, in combination with high oxidation resistance as well as high heat conductivity makes their use at operating temperatures up to 1700°C attractive. This combination of high specific strength with low specific weight is advantageous in aviation and rocket technology. At high rates of heat transmission, the beryllides exhibit the same resistance to thermal shock as ThO_2, ZrO_2, and Al_2O_3. G.G.

N66-35178*# Temple Univ., Philadelphia, Pa. Dept. of Chemistry.
IMPROVED PREPARATION OF 9-OCTADECENES
Martin E. Dyen, Herman C. Hamann, and Daniel Swern 1966 10 p refs Submitted for Publication
(Grants NSG-(T)-140; PHS CA-07803; PHS CA-07174)
(NASA-CR-77468) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Cis- and trans-9-octadecenes have been obtained in about 55–60% yield on a preparative scale by an improved procedure from commercially pure oleyl alcohol (90–95%) and elaidyl alcohol, respectively, by conversion to the tosylates followed by reduction with lithium aluminum hydride (LAH). The improvement consists in suing saturated sodium chloride solution to coagulate the slimy, intractable, insoluble salts obtained after the LAH reduction and destruction of excess LAH with water, prior to ether extraction of the crude hydrocarbons. Total time required for the preparation is about three days. Author

N66-35226*# Lexington Labs., Inc., Cambridge, Mass.
DEVELOPMENT OF PIGMENTS FOR THERMAL CONTROL COATINGS Final Report, 17 Jun.–16 Dec. 1965
Philip S. Schaffer and David W. Jones Apr. 1966 51 p refs
(Contract NAS8-20162)
(NASA-CR-77481) CFSTI: HC $3.00/MF $0.50 CSCL 07B

The feasibility of producing powders of alumina (Al_2O_3) zirconia (ZrO_2), silica (SiO_2), titania (TiO_2), zinc oxide (ZnO) and zinc titanate ($ZnTiO_3$) by homogeneous nucleation in the vapor phase was determined. The general reaction used, whereby a metal chloride was initially formed by flowing a controlled amount of chlorine gas over a metal source, then reacted with controlled amounts of carbon dioxide and hydrogen gases, is shown:

$$MCl_{2x}(g) + xCO_2(g) + xH_2(g) \rightleftharpoons MO_x(s) + xCO(g) + 2xHCl(g)$$

Appropriate growth parameters for the individual materials were determined. Samples prepared did not have unusual

radiation stability, but the capability of producing powders of extremely uniform particle size and of controlled composition was demonstrated. Author

N66-36249# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Radiochemie.

TERNARY OXIDES OF THREE-VALENT TO SIX-VALENT AMERICIUM [TERNAERE OXIDE DES DREI- BIS SECHS-WERTIGEN AMERICIUMS]

Karl-Heinz Walter Jan. 1965 76 p refs In GERMAN (KFK-280)

The reactions of AmO_2 with oxides of other elements at high temperatures were investigated. The alkali oxides Li_2O and Na_2O react with AmO_2 under suitable research conditions to ternary oxides with 3-, 4-, 5-, and 6-valent Am. The thermal stability of the individual compounds decreases with increasing valency of Am. The decomposition temperatures are much lower than that of the analogous ternary oxides of U, Np, and Pu. Ternary oxides of 4-valent Am could be prepared with the oxides of Pa and Sr. In the thermal reaction of AmO_2 with the oxides of the elements of the fifth group, a decomposition of the Am(IV) to Am(III) occurs. In these compounds Am in its chemical behavior shows extensive analogies to the rare earth. Because of the self-radiation of Am^{241} the compounds of Am undergo a change of the lattice parameters with increasing storage time. This is produced through the transposition of the lattice units to interstitial lattice positions through the α-particles emitted and the recoil atoms occurring in the decay. The time behavior or the relative alteration of the lattice constants were followed in the compounds AmO_2, $Am_2Hf_2O_7$, and Li_4AmO_5. The ternary and quarternary oxides prepared with the results of X-ray studies are tabulated. Author (NSA)

N66-36257# Puerto Rico Nuclear Center, Mayaguez.

NEUTRON DIFFRACTION PROGRAM Summary Progress Report No. 4, May 1965–Apr. 1966

M. I. Kay, I. Almodovar, J. A. Gonzalo, D. T. Cromer, and K. Okada Apr. 1966 55 p refs (Contract AT(40-1)-1833) (PRNC-84) CFSTI: HC $3.00/MF $0.50

The results of neutron diffraction studies on copper formate tetrahydrate, alums, d-tartaric acid, and magnetic structure of ζ Pd_2Mn_2 are reported. The disordered hydrogen positions in copper formate tetrahydrate at room temperature were found and some of the properties of the antiferroelectric transition at −40°C determined. The structure including hydrogens of the three Alum ($A^{+}B^{3+}$) $(SO_4)_2 \cdot 12H_2$) types (α, β, γ) were refined by neutron diffraction data. Special attention was given to the β Alum, Cs Al $(SO_4)_2 \cdot 12H_2O$. The structure of d-tartaric acid was refined. The hydrogen bonding scheme was unequivocally defined by the neutron data. Studies on Pd_2Mn_2 showed that the ζ phase is antiferromagnetic, and the magnetic cell is related to the tetragonal chemical cell by transformations. The magnetic moment for Mn is 4.1±0.2 μ. The spins are aligned perpendicular to the c axis and the magnetization closely follows a Brillouin dependence from room temperature to the Neel point. Author (NSA)

N66-36280# United Nuclear Corp., Elmsford, N. Y. Research and Engineering Center.

STUDY OF URANIUM–PLUTONIUM MONOXIDES Final Summary Report

J. Andersen, K. Taylor, R. L. Forbes, and N. Fuhrman (Carborundum Co.) 31 Jan. 1966 81 p refs Prepared jointly with Carborundum Co.
(Contract AT(30-1)-3305) (UNC-5144; EURAEC-1566) CFSTI: HC $3.00/MF $0.75

Uranium–plutonium monoxide compositions of the types $(U_{0.9}Pu_{0.1})(O_xC_{1-x})$ and $(U_{0.9}Pu_{0.1})(O_xC_yN_z)$ were synthesized by carbon and uranium reduction methods starting with UO_2–PuO_2 mixtures. Pure (UPu)O or PuO compounds, as well as nitrogen-stabilized uranium–plutonium monoxides $(U_{0.9}Pu_{0.1})(O_xN_{1-x})$, could not be synthesized. The maximum oxygen content found in essentially single-phase $(U_{0.9}Pu_{0.1})(O_xC_{1-x})$ was approximately x = 0.4. Higher monoxide oxygen contents, approaching x = 0.6, were found in materials containing 15% or more of a dioxide phase. Nearly single-phase $(U_{0.9}Pu_{0.1})(O_xC_yN_z)$ compositions were obtained when the intended oxygen content was no greater than x = 0.3 and the O/C atom ratio was no more than 1. $Pu(O_xC_{1-x})$ compositions were prepared having estimated oxygen contents as high as x = 0.6. Corrosion testing to evaluate these fuels for water-cooled thermal reactor application demonstrated that: in boiling water, the $(U_{0.9}Pu_{0.1})(O_xC_{1-x})$ materials hydrolyzed while $(U_{0.9}Pu_{0.1})(O_xC_yN_z)$ compositions with carbon contents less than y = 0.4 were essentially unaffected; and in 550°F water, all monoxide-type materials disintegrated. Typical monoxide-type compositions appeared to have higher room temperature thermal conductivities than those of $(UPu)O_2$ and UO_2 Author (NSA)

N66-36269# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.

THE SEGREGATION OF UO_2 AND ThO_2 POWDERS MIXED TO FINE-SCALE HOMOGENEITY

K. R. Poole and R. W. Wake May 1966 18 p refs (AERE-M-1706) HMSO: 3s

A brief investigation into the segregation which occurs when mixtures of nuclear fuel oxide powders are handled has been carried out using a mixture of UO_2 and ThO_2. The influence of free pouring and conveying down an inclined chute have been studied. It is concluded that the degree of segregation which occurs is of little practical significance and that a similar result would be expected with any mix containing an agglomerating material like UO_2. Author

N66-36272# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

A GALVANIC CELL FOR MEASURING THE URANIUM ACTIVITY IN CARBIDES AT HIGH TEMPERATURE

E. J. Mc Iver Apr. 1966 24 p refs (AERE-R-4983) HMSO: 3s

A high temperature galvanic cell with a fused salt electrolyte has been developed and used for measuring the uranium activity in uranium carbides. The free energy of formation of UC has been found to be, $\Delta G_{UC} = -20,300 - 1.6T$°C calories, and of UC_2 to be $\Delta G_{UC_2} = -24,200 + 0.9T$°C calories. The dissolution of oxygen in UC_2 has been found to lower its free energy of formation by as much as 5.4 kcals at 1000°K. Author

N66-36277# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.

X-RAY FLUORESCENCE ANALYSIS. PART I: BIBLIOGRAPHY

H. A. Stoddart and W. A. Dowden May 1966 224 p refs (AERE-BIB-136) HMSO: 27s

A bibliography on X-ray fluorescence analysis is presented. The references cover the book, periodical, report, and conference literature from 1957 to the end of 1964. C.T.C.

N66-36300# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

THE DETERMINATION OF ZIRCONIUM IN CERAMIC MAGNESIA BY NEUTRON ACTIVATION ANALYSIS

C. A. Baker Apr. 1966 20 p refs
(AERE-R-5108) HMSO: 2s 6d

A method is described for the determination of parts per million of zirconium in ceramic magnesium oxide by thermal neutron activation. The chemical separation of radio-zirconium is based on the precipitation of $BaZrF_6$ and is a modification of an established method for the determination of radio-zirconium in fission products. Several methods are presented for inspecting the results to ensure an absence of interference from fission product zirconium activity. The limit of detection is 0.1 μg for a flux of 10^{12} n/sec/cm^2. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-34117# RAND Corp., Santa Monica, Calif.
SIMULATION OF THE 1% MINIMUM CROSSTALK LOSSES AT VOICE FREQUENCIES IN A PAIRED CABLE BY MEANS OF A LUMPED PARAMETER NETWORK
M. Landis and D. G. Aviv (RCA, New York) Jun. 1966 11 p ref
(P-3379; AD-634182) CFSTI: HC $1.00/MF $0.50

The design of a crosstalk simulator, which simulates the "1% minimum' crosstalk loss condition in a paired cable at voice frequencies, is presented. The simulator is composed of two or more balanced artificial lines coupled to one another at each node by means of equivalent crosstalk capacitors. The capacitor node connections follow prescribed rules, resulting in the total unbalanced capacitance between the disturbing and disturbed lines varying as a function of the square root of line length (number of sections). The near-end and far-end crosstalk loss calculations obtained with the simulator compare within a fraction of one decibel with the corresponding crosstalk loss evaluation in a smooth cable. Analysis of the simulator model leads to a general result, which can be used for any crosstalk condition specified by (1) the number of disturbers, (2) the magnitude of unbalanced capacitance, (3) signal levels, or (4) the probability of occurrence. The simulator is also useful in evaluation of error rate as a function of crosstalk interference. Author (TAB)

N66-34121# Mitre Corp., Bedford, Mass.
THE ABILITY TO PREDICT LOW-ANGLE HEIGHT ERRORS WITH THE NBS SURFACE-CORRECTED MODEL ATMOSPHERE
Lyall G. Rowlandson Bedford, Mass., Electron. Systems Div., Jun. 1966 37 p refs
(Contract AF 19(628)-5165)
(MTR-113; ESD-TR-66-83; AD-634372) CFSTI: HC $2.00/MF $0.50

A comparison is made between values of radio ray bending which is calculated in two ways: one using a ray-tracing computation based on radiosonde data; and the other using the National Bureau of Standards exponential reference atmosphere (1959) corrected to match the refractivity measured at the surface. The refractivity data for the ray-tracing computations were obtained from twice-daily radiosonde soundings taken at Albany, New York, and Nantucket, Massachusetts. During July and November 1963, results indicate that the NBS model does not completely remove height errors, but it can be used effectively to offset errors due to slow seasonal changes bending conditions. The correction technique is not effective during periods of anomalous propagation. A review of more recent prediction techniques (1963) is presented, and recommendations are made for their field evaluation. Author (TAB)

N66-34165# North American Aviation, Inc., Downey, Calif.
ORBIT DIFFERENTIAL CORRECTION-TRACKING PROGRAM. VOLUME III: SATELLITE ORBIT PREDICTION PROGRAM Final Report
George E. Townsend Griffiss AFB, N. Y., RADC, Apr. 1966 199 p refs
(Contract AF 30(602)-3638)
(SID-65-1203-3; RADC-TR-66-67, Vol. III; AD-633628) CFSTI: HC $5.00/MF $1.25

This document presents the formulation, computational logic, and coding information developed for the purpose of tracking an artificial earth satellite in an open-loop mode. The program was developed as a Fortran IV, IBM 7094 program which uses the standard North American aviation monitor system (NAASYS version 13). The logic presented is intended for use in developing a similar program for the Packard Bell 250 digital computer. The trajectory prediction portion of the program is a general perturbation formulation developed by Anthony G. Lubowe of Bell Telephone Laboratories. The tracking portion of the program can accept as many as ten tracking stations and outputs range, range-rate, azimuth and elevation data. Author (TAB)

N66-34173# Army Electronics Labs., Fort Monmouth, N. J.
TECHNIQUE USED IN DETERMINING FIELD OPERATIONAL RELIABILITY
Joseph W. D'Oria May 1966 18 p ref
(ECOM-2709; AD-634385) CFSTI: HC $1.00/MF $0.50

The report depicts several of the problems involved in conducting an investigation to determine the operational reliability of an army radio set utilized under actual field conditions. A reporting form was distributed to the troops prior to the exercise commencement. The form was designed to require little time for its completion and yet yield sufficient information for meaningful analysis. Three different monitoring techniques were studies to determine which would provide the most accurate and informative data with the manpower and facilities available. The technique employed was to visit each operating site twice daily, checking the reporting form against the operator's daily log; in the event of a system failure occurrence, interview both the operator and maintenance man, recording all data pertinent to the failure. Due to the lack of manpower, accurate maintenance information could not be obtained after failed equipment was sent from the operating site. Analysis of the data revealed the presence of a bias. The equipment had been used regularly at least several months prior to the exercise commencement, however, approximately thirty percent of the failures occurred in the first 420 hours; potential causes of this bias are discussed in the body of the report. Author (TAB)

N66-34174# Naval Research Lab., Washington, D. C.
RESULTS OF AIRBORNE FIELD MEASUREMENTS IN THE ANTIPODAL REGION OF RADIO STATION NPM, HAWAII Final Report
J. E. Rogerson 26 Apr. 1966 38 p refs
(NRL-6373; AD-633698) CFSTI: HC $3.00/MF $0.75

The U.S. Naval Research Laboratory is conducting a comprehensive investigation of very-low-frequency (vlf) radio wave propagation. The objective of this investigation is to determine the parameters necessary for predicting the reliability of vlf communications in the ocean areas of the world. It is believed that an investigation of the electromagnetic fields at and near the antipode of a vlf transmitter would provide much propagation information. Since all the antipodes of the Navy vlf transmitter stations, except for station NPM in Hawaii, are located in remote ocean areas, this makes them operationally difficult to investigate, especially with respect to navigation. The NPM antipode, however, is located on land near Ghanzi, Bechuanaland Protectorate, in the Kalahari Desert in southern Africa. Navigation in the vicinity of the NPM anitpode could conceivably be more precise than in other antipodal areas. An analysis of the data obtained in July 1963 by the Naval Research Laboratory via aircraft flights in the vicinity of the antipode of radio station NPM, Hawaii (19.8-kHz transmitter) is presented. Definite evidence of convergence of field strengths was found, as expected; a peak value of 2.0 mv/m for the field was measured during the experiment. Indications of an inverse square root dependence on distance for the field strength were observed. The expected diurnal pattern of highest field strengths at local sunrise, lowest fields at local sunset, and intermediate fields at noon and midnight was found to be true. Author (TAB)

N66-34178# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ACCURACY OF TRACKING AIRBORNE TARGETS

Edgar A. Murray Oct. 1965 42 p

(BRL-TN-1587; AD-634603) CFSTI: HC $2.00/MF $0.50

Tracking tests of an airborne target were made with a tracking telescope to determine accuracy that could be expected under optimum conditions. The desired accuracy is 0.15 milliradians or better for at least ten percent of a critical period lasting approximately 15 seconds. Considerably difficulty was experienced in alignment of the relatively low power guiding scope with the main tracking telescope. This problem was solved by inserting a beam splitter, used for fine tracking, in the main optical system. The results show that the target was tracked from 6 percent to 12 percent of the critical period. Author (TAB)

N66-34182# Naval Research Lab., Washington, D. C.

PITCH VARIATION IN VOCODED VOICE Final Report

W. M. Jewett 20 May 1966 33 p refs

(NRL-MR-1699; AD-534162) CFSTI: HC $2.00/MF $0.50

In the analysis of the KY-537/U channel vocoder for the Bureau of Ships, a study was performed of the pitch variations in the vocoded digital data signal using three untrained male speakers. The results obtained were compared to published data for the pitch perturbations in natural speech for trained speakers. The comparison indicates that statistically the variations in pitch between successive voiced vocoder frames were zero a much larger percent of the time than found in natural speech, and also that large changes in pitch occurred more often than in the reference data. This is partly the result of using a quantization interval in the vocoder that is too large to permit encoding the small pitch variations which account for most of the pitch perturbations that occur in natural speech. The extension of this work using a larger number of speakers under different stress and background noise conditions would yield data of value on the adequacy of the pitch extractor in presently designed channel vocoders, the need for speaker training, and possible constraints on vocoder use. Author (TAB)

N66-34203# Tufts Univ., Medford, Mass. Dept. of Mechanical Engineering.

A STUDY OF ACOUSTICAL MULTIPATH SYSTEMS. SECTION II: SUBJECTIVE TESTING Final Report

H. Geoffrey Fisher 1 Jun. 1966 16 p ref

(Contract Nonr-494(00))

(AD-634369) CFSTI: HC $1.00/MF $0.50

An attempt was made at examining the effect of various signal-to-noise ratios (S/N) on speech. Author (TAB)

N66-34205# Washington Univ., Seattle. Dept. of Electrical Engineering.

SCATTERING OF A SURFACE WAVE FROM AN ABRUPT CHANGE IN THICKNESS ON A DIELECTRIC SLAB Technical Report No. 105

William W. Cooley and Akira Ishimaru Mar. 1966 66 p refs

(Contract AF 19(628)-2763)

(AFCRL-66-249; AD-634150) CFSTI: HC $3.00/MF $0.75

Surface wave scattering is of interest in antenna design and radio propagation. This report obtains an approximate solution for the scattering of a TM surface wave from a step change in thickness on a ground dielectric slab, a problem which can not be solved exactly. The solution is developed from a new integral formula by a technique similar to the Born approximation. An integral formula is developed by applying the divergence theorem to two different problems which are related to the original, but because of their geometry are simpler to solve. This integral formula is then specialized to the two dimensional case for both TE and TM polarizations. The scattering of a TM surface wave from a step change in thickness on a grounded dielectric slab is determined from an approximate solution of the integral formula. The approximation made is similar to the Born approximation, but different in that two known solutions are used rather than one. Radiation patterns and the total fraction of incident power scattered are calculated for both of the possible directions of incident wave. An equivalent circuit description of the discontinuity is also mentioned. Results of the analysis are compared favorably with previous workers in the special case of an abruptly terminated dielectric slab. Some experimental work is included to support the theoretical development. Author (TAB)

N66-34220# Raytheon Co., Alexandria, Va. Autometric Operation.

MODES OF SATELLITE TRIANGULATION ADJUSTMENT, VOLUME I Final Technical Report, 23 Sep. 1965-20 Apr. 1966

Michael W. Creusen and Soren W. Henriksen Apr. 1966 40 p refs

(Contract DA-44-009-AMC-1327(X))

(Rept.-163; AD-633863) CFSTI: HC $2.00/MF $0.50

This report describes the development of a computer program that will perform a satellite triangulation-adjustment, using the direction numbers of the straight lines in space that connect the different camera stations. The program computes the approximate values of the coordinates of all camera stations. These coordinates are used to form the proper observation equations for a least squares adjustment, yielding the adjusted coordinates and their variance matrix. This report consists of two parts: the general program description and a collection of descriptions of the subroutines used. It is concluded that the work has been performed according to the contract. It is concluded further that other recent work in this area may merit investigation. Author (TAB)

N66-34272# Electronic Associates, Inc., Princeton, N. J.

VOICE ACTUATED ADDRESS MECHANISM Final Report, 1 Mar.-28 Feb. 1966

Donald Fraipont 31 Mar. 1966 43 p refs
(Contract DA-28-043-AMC-01223(E))
(Rept.-3; AD-633711) CFSTI: HC $2.00/MF $0.50

This is the third and final progress report relating to the development of a simulation of a voice actuated address mechanism. An overall summary of the entire project is included here along with the third phase experiments of the simulation. All third phase work was pointed toward improving the extrapolated recognition rate to a practical field usage level. The final results obtained for ten new speakers each voicing the fifteen word vocabulary twice were: recognition rate equal 6.0%. These results, while not yet at a field use level, are better than any previously published figures relating to similar experiments. Author (TAB)

N66-34285# Navy Electronics Lab., San Diego, Calif.
A HIGH-FREQUENCY PROPAGATION PREDICTION PROGRAM FOR THE CDC 1604 COMPUTER Research and Development Report, Apr. 1964–Sep. 1965
D. B. Sailors 28 Feb. 1966 331 p refs
(NEL-1358; AD-633716) CFSTI: HC $7.00/MF $1.75

Two programs are presented, written in NELIAC 5M for the CDC 1604 computer. The basic geometry, which organizes equipment parameters for computer handling and makes preliminary calculations, and the HF propagation prediction program, which calculates critical frequencies, losses, S/N ratio, and signal strength for each link. Average calculation time for each link for each time of day, month, and sunspot number is about 7 seconds, as compared to about 10 hours by hand calculation. Assumptions, operating instructions, auxiliary routines, description of outputs, and error indications are included. Author (TAB)

N66-34318*# Melpar, Inc., Falls Church, Va.
THIN-FILM PERSONAL COMMUNICATIONS AND TELEMETRY SYSTEM (TFPCTS) First Quarterly Progress Report, 24 Mar.–24 Jun. 1966
Jul. 1966 50 p
(Contract NAS9-3924)
(NASA-CR-65457) CFSTI: HC $2.00/MF $0.50 CSCL 09F

A set of twin-T filters for removing the harmonics of the low channel voltage-controlled oscillators (VCO) which would interfere with the higher channels was fabricated. To obtain the bandwidth required to reject the harmonics over the total deviated bandwidth, two twin-T filters are stagger-tuned. A single substrate is used for a stagger-tuned pair. Discrete components were used in the fabrication of the VCO's. An aging process was investigated for the thin-film active devices in order to stabilize the drain current at constant bias voltage. A complete set of masking drawings for the designed modules is presented, and a list representing the complete set of circuit modules that will be required for the transceiver is given. A block diagram and a strip chart recording of the frequency spectrum in the VCO and filter subsystem passband is contained in addition to a general description. Two types of conformal coatings were investigated for packaging the thin-film devices, and thermoplastic material was considered in the development of a rigid external package. K.W.

N66-34357# Joint Publications Research Service, Washington, D. C.
BAYESIAN BINARY SYSTEMS OF RECEIVING SIGNALS INVARIANT IN RELATION TO NOISE POWER
Yu. P. Kuznetsov *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 18–22 ref (See N66-34353 20-10) CFSTI: $3.00

The problem of constructing Bayesian binary systems for receiving signals when noise power is an unknown value is analyzed. The reception of two signals with random amplitudes is examined, and the rule of decision making for systems of receiving these signals is determined. It is found that the rule of making a decision in general depends upon the noise power, but equations are derived for conditions in which decision making does not depend on noise power. The derivation of the various equations is shown, and the probability calculations are demonstrated. It is noted that the methods used in this study have also been applied to other classes of signals, particularly for signals with random phases and for signals with random amplitudes and phases. A.G.O.

N66-34360# Joint Publications Research Service, Washington, D. C.
SEVERAL PROBLEMS IN RECOGNIZING ACOUSTIC SIGNALS
D. N. Kartashov, A. A. Nigay, and V. Ya. Petrov *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 35–38 (See N66-34353 20-10) CFSTI: $3.00

The feasibility of designing units to recognize various acoustic signals whose characteristics possess certain stationary parameters is reported. Technical methods used in the experiment are briefly described, and the development of acoustic signal representations is presented. The algorithms of recognition are shown, and test results are diagrammed. It is concluded that for a number of comparatively simple problems linear methods of space representations can be used rather effectively. A.G.O.

N66-34361# Joint Publications Research Service, Washington, D. C.
A CLASS OF METRICS IN PROBLEMS OF RECOGNIZING DIAGRAMS BY THE METHOD OF R-FUNCTIONS
I. B. Sirodzha *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 39–45 refs (See N66-34353 20-10) CFSTI: $3.00

The application of a class of metrics to pattern recognition problems by the method of R-functions is presented. The mathematical method is given in which equations are used to describe arbitrary drawings assigned by coordinates of points on a plane, and to reduce the problem of recognizing geometric shapes to that of recognizing their analytical functions with the aid of a digital computer. Selection of a class of metrics in problems of recognizing visual patterns is shown, and the various numerical determinations in the development of optimal algorithms are discussed. A.G.O.

N66-34364# Joint Publications Research Service, Washington, D. C.
CONSTRUCTING A TREE WITH MINIMUM WEIGHT
I. I. Vayner and Ya. V. Gural'nik *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 63–70 refs (See N66-34353 20-10) CFSTI: $3.00

A search by sequential improvement of variants similar to the gradient method is proposed for determining the minimum weight function for a set of trees. An arbitrary tree was selected as the original variant, and the direction of transition to the following variant is determined according to maximum reduction in the weight function. Algorithms are given for constructing a tree with minimum weight. It is pointed out that, in practice, the first approximation to a net with minimum value for a set of trees serves as a tree with a minimum overall length of edges. If such a tree is selected as the original, then there is greater probability that it can immediately fall into the

region of the absolute minimum. It is also noted that where at least two trees have an identical weight value, a nonspecificity develops in the use of the algorithm; such cases require verification according to the algorithm. A.G.O.

N66-34378*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ERROR RATE REDUCTION OF PARITY CHECKED TELEMETRY DATA BY LIKELIHOOD DELETION STRATEGY

Dale R. Lumb and Frank Neuman Washington, NASA, Aug. 1966 46 p refs

(NASA-TN-D-3576) CFSTI: HC $2.00/MF $0.50 CSCL 09F

Scientists with experiments on interplanetary space probes receive telemetered data which contain undetected errors. The significance of the error rate depends upon the experiment. This paper presents a technique for reducing the error rate by deleting words that are likely to have errors which are not detected by a parity check code. Consequently trade-offs can be made between the word error rate and the word deletion rate for binary data words that are received from a deep space probe at a constant transmission rate. These trade-offs are based on a consideration of the matched filter (data demodulator) level output of each received bit, in addition to the binary decision data usually used from the data demodulator. In the report, the theoretical foundations for the proposed error detection scheme are laid. It is shown that the theoretical model agrees reasonably well with results obtained from existing space communications hardware. Author

N66-34405*# Computing Devices of Canada, Ltd., Ottawa (Ontario).

HIGH SHOCK FM TRANSMITTER Final Report, Phase II

G. E. Brown, J. R. Beck, and J. E. Dawson 14 May 1966 92 p *lts* Rept.-7061/R2

(Contract NAS1-5042)

(NASA-CR-66160) CFSTI: HC $2.50/MF $0.75 CSCL 09F

Electric and shock tests are described for both a prototype and final high shock FM transmitter. Also included are descriptions of the final case design, transmitter circuit, temperature compensating capacitor tests, and compressed air launcher tests using strain gauge test spheres. Results of impact tests on three transmitters indicate that frequency shifts between +33 and +120 kHz can be expected for impacts along any axis at velocities between 100 and 150 ft/sec. For lower velocities, frequency shifts will probably be much lower. A positive shift in frequency lasting 0.3 millisec occurs during impact, and is sometimes followed by a negative shift of shorter duration and generally lower amplitude. Damage to the transmitter during the impact tests was considerably greater than expected, including complete failure of the cases and damage to the components and plastic module. While the present performance of the high shock transmitter requires improvement, it is noted that the transmitter is capable of meeting all the electrical specifications, and frequency stability during the impacts was very high. M.W.R.

N66-34406*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPECTRAL ANALYSIS APPLIED TO A DIGITALLY CODED PM RF CARRIER

R. C. Woodbury 15 Aug. 1966 19 p refs

(Contract NAS7-100)

(NASA-CR-77311; JPL-TR-32-893) CFSTI: HC $1.00/MF $0.50 CSCL 09F

To ensure a high degree of confidence in calibrating a digitally coded phase-modulated (PM) system, it is desirable to calibrate directly in terms of the digital modulation. The complexity of the spectra resulting from the single-tone case suggests that the spectra from a digitally modulated PM system must be extremely complex and are, therefore, not usable for direct calibration. This report demonstrates that the contrary is true, by investigating the spectrum of a square-wave PM carrier. It is shown that the spectra obey simple relationships which permit accurate calibration of a PM system. The geometric tolerances of the square- and trapezoidal-wave modulation functions are investigated in terms of harmonic content. It is shown that the symmetry and the rise-time of these functions provide a sensitive indication of the performance of a PM system. Author

N66-34446# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON THEORY OF INFORMATION

B. R. Levin, ed. 9 Aug. 1966 110 p refs Transl. into ENGLISH from the Publ. "XXII Vsesoyznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio—Sektsiya Teorii Informatsii" Moscow, 1966 p 3-109

(JPRS-36910; TT-66-33340) CFSTI: $4.00

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12. CONSTRUCTION OF OPTIMUM STABILIZATION SYSTEMS IN THE PRESENCE OF RANDOM PERTURBATIONS I. P. Lytkin p 64-67 refs (See N66-34458 20-07)

13. SELECTION OF CRITERION IN STATISTICAL THEORY OF COMMUNICATIONS A. A. Voronin p 68–70 refs (See N66-34459 20-07)

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17. FOUR-PARAMETER DISTRIBUTION OF SIGNAL'S AMPLITUDE AND PHASE-GENERALIZED DISTRIBUTION FOR RADIO CHANNELS WITH RANDOM-CHANGING PARAMETERS D. D. Klovskiy and I. M. Samusenko p 91–96 refs (See N66-34463 20-07)

18. POTENTIAL NOISEPROOF FEATURES IN CHANNELS WITH FOUR-PARAMETRIC DISTRIBUTION OF SIGNAL'S AMPLITUDE AND PHASE D. D. Klovskiy and I. M. Samusenko p 97–102 refs (See N66-34464 20-07)

19. THE USE OF DEPENDENT TESTS FOR OPTIMIZING PLANNED SYSTEMS IN ACCORDANCE WITH A STATISTICAL INDICATOR Yu. G. Pollyak p 103–105 refs (See N66-34465 20-07)

N66-34447# Joint Publications Research Service, Washington, D. C.

INFORMATICS

F. E. Temnikov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 1–4 refs (See N66-34446 20-07) CFSTI: $4.00

Informational categories, processes, and systems are described to form a definition of "informatics," a theory of information related to communications. Technical fields such as automation, computers, and linguistics, which illustrate the use of ideas of informatics are listed. Informational categories consist of ideas, codes, signals, and measures. The following forms of informational processes also enter into the definition of informatics: perception, transmission and processing, representation, and activation. The third aspect of informatics discussed is the information system, which consists of elements, structure, behavior, and organization. S.P.

N66-34448# Joint Publications Research Service, Washington, D. C.

OPTIMUM CODING IN THE PRESENCE OF UNKNOWN AND CHANGING COMMUNICATION STATISTICS

B. M. Fittingof *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 5–9 (See N66-34446 20-07) CFSTI: $4.00

Equations are presented to illustrate the basic concepts of communication and coding, communication statistics, and optimum coding. Theorems are provided for proving the condition of optimum coding in the presence of unknown communication statistics. S.P.

N66-34449# Joint Publications Research Service, Washington, D. C.

POTENTIAL NOISEPROOF FEATURE AND METHODS OF OBTAINING OPTIMAL CODES

N. L. Teplov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 11–14 refs (See N66-34446 20-07) CFSTI: $4.00

An optimum code is defined as a code with equal distances between the code-signals, and equations are presented for determining the distance between code-combinations in an equidistant code. The potential noiseproof feature (with respect to white noise) of an optimum code is determined by an expression for the probability of an error. Methods of building orthogonal codes are discussed and optimum methods of decoding discrete communications, such as recording by elements and receiving complete code-signals, are briefly described. S.P.

N66-34450# Joint Publications Research Service, Washington, D. C.

ADAPTIVE RECEPTION WITH IRREGULAR DIFFERENCES BETWEEN INTERFERENCE AND PULSE-SIGNAL WITH PASSIVE INTERVAL

Sh. M. Chabdarov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 14–18 refs (See N66-34446 20-07) CFSTI: $4.00

Irregular differences between the interference and the signal are assessed in relation to the potential possibilities of adaptive selection. Internal interferences in multichannel asynchronous systems, with the channels divided according to the probabilities or the codes, are cited as an example. Due to the random spread of the radio channel parameters of an asynchronous system, the signal's symptoms are not known in advance and the receiver must tune itself automatically to the signal. Equations are formulated for determining the probability of distorting a pause in a selector along the amplitude, the carrier frequency, and the initial phase of the carrier frequency. Based on the results of these calculations, it is pointed out that a fairly high probability of correct reception can be attained even in the presence of interference. It is also concluded that adaptive selection makes it possible to use a coding in which a passive pause predominates. S.P.

N66-34451# Joint Publications Research Service, Washington, D. C.

THE USE OF TIME-DISCRIMINATION TO DETERMINE THE DISTRIBUTION OF DURATION OF OVERSHOOTS OF NORMAL NOISE ENVELOPE

B. R. Levin and Ye. A. Fomin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 19–27 refs (See N66-34446 20-07) CFSTI: $4.00

A discussion is presented on the duration-distribution of overshoots of normal stationary noise envelopes above the specified threshold level and the interval between the overshoots. Approximate solutions are given for distributions obtained for any value of the threshold level. An independent and single-connected approximation of duration-distribution of the overshoots of the envelope of a normal stationary process with a single dispersion expressed by means of one-dimensional and two-dimensional integral distribution functions. S.P.

N66-34452# Joint Publications Research Service, Washington, D. C.

CONCERNING THE AVERAGE COINCIDENCE-FREQUENCY OF OVERSHOOTS IN RANDOM PROCESSES

E. F. Babushkin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 28–35 refs (See N66-34446 20-07) CFSTI: $4.00

Statistical characteristics of coinciding continuous random processes are discussed, and an expression is developed for the average frequency of coincidences of overshoots a in continuous random processes. Results are obtained and applied to the coincidences of instantaneous values of the envelopes and of the phases of steady normal signals at the

output of a symmetrical two-channel linear selective system. Technical application is mentioned in the areas of coincidence of noise-overshoots, signals of multi-channel radio devices, and effectiveness of weak-signal noise detecting systems. S.P.

N66-34453# Joint Publications Research Service, Washington, D. C.

CONCERNING THE THEORY OF ENERGY-SPECTRA OF GROUPED RANDOM PULSED PROCESSES WITH DETERMINED CADENCE INTERVAL

V. E. Gurevich, G. V. Kunovalov, and E. M. Tarasenko *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 36–42 refs (See N66-34446 20-07) CFSTI: $4.00

An evaluation of the energy-spectrum of a signal representing a random sequence of pulse groups with a determined cadence interval is presented for analysis of problems connected with synchronous transmission of discrete information. General relationships for energy-spectra of group-signals with consideration of all correlating connections between the homogeneous parameters of the pulses are presented. The fitness of the obtained expressions for evaluating the spectra of the signals when using uniform codes is illustrated by specific examples of transmission of information with the aid of natural direct binary codes and with a binary code containing a constant number of units. S.P.

N66-34454# Joint Publications Research Service, Washington, D. C.

USE OF PREDICTION WITH THE AID OF DERIVATIVES FOR BUILDING NOISEPROOF RECEPTION OF DISCRETE SIGNALS

I. V. Terent'yev *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 43–44 (See N66-34446 20-07) CFSTI: $4.00

The use of derivatives for predicting the noiseproof reception of discrete signals for channels with random functions presented as a root-mean-square form of Taylor series is discussed. It is concluded that only receivers with prediction units prove to be useful when, in the widening band of the receiver, it is possible to obtain any small probability of error and large carrying capacity for the channel. S.P.

N66-34455# Joint Publications Research Service, Washington, D. C.

POSSIBLE WAYS OF OBTAINING EXACT LINEAR PREDICTION OF STATIONARY TIME SERIES BY THE METHOD OF LEAST SQUARES

I. G. Khanovich and G. G. Yanovskiy *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 44–49 refs (See N66-34446 20-07) CFSTI: $4.00

Various theories of linear forecasting are reviewed, and a method is proposed for obtaining more exact results of the linear prediction based on the known error in the predicted values of the function f(t). Equations are formulated for estimating the relative error in the prediction results. The prediction interval is then divided into a small number of intervals, and the value of the function is determined by information specified in the interval. All preceding predicted discrete values are taken into account. An example is included of a random telegraph signal, to illustrate the suggested method. S.P.

N66-34456# Joint Publications Research Service, Washington, D. C.

SOLUTION OF PROBLEM ABOUT OPTIMUM LINEAR FILTER AT THE OUTPUT OF MULTIPLIER

D. L. Burachenko *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 50–55 refs (See N66-34446 20-07) CFSTI: $4.00

The pulse function of an optimum filter at the output of a multiplier is determined for a general case of correlated noises acting from the signal and reference channels. It was assumed that the signal and the reference oscillation have different shapes. A diagram of the circuit considered is shown and equations relevant to the solution of the problem are derived. H.S.W.

N66-34457# Joint Publications Research Service, Washington, D. C.

A POSTERIORI DISTRIBUTION-DENSITY OF PROBABILITIES OF ERRORS AT OUTPUTS OF IDEAL RECEIVER ON ANALOG SIGNALS

A. F. Fomin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 56–63 refs (See N66-34446 20-07) CFSTI: $4.00

It is stated that the most that a single receiver is able to accomplish is to calculate the specified density of distribution of the a posteriori probabilities of communications, and that this distribution density is a random function governed by a complex law of distribution. An expression for determining the mathematical expectancy of this random function is derived. H.S.W.

N66-34458# Joint Publications Research Service, Washington, D. C.

CONSTRUCTION OF OPTIMUM STABILIZATION SYSTEMS IN THE PRESENCE OF RANDOM PERTURBATIONS

I. P. Lytkin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 64–67 refs (See N66-34446 20-07) CFSTI: $4.00

Theorems are provided for determining the acceptable and optimum controls for negating the action of outside random perturbations in radio engineering stabilization systems. H.S.W.

N66-34459# Joint Publications Research Service, Washington, D. C.

SELECTION OF CRITERION IN STATISTICAL THEORY OF COMMUNICATIONS

A. A. Voronin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 68–70 refs (See N66-34446 20-07) CFSTI: $4.00

It is stated that the large variety of criteria hinders a comparative analysis of various aspects of the statistical theory of communications, although one prospective approach is discussed. The logic of this approach is examined; however, it is concluded that no method of selecting an optimum algorithm exists which is more effective than the conventional method of sampling all possible algorithms. H.S.W.

N66-34460# Joint Publications Research Service, Washington, D. C.

OPTIMUM PROGRAM OF MULTIALTERNATING DETECTION IN MULTIPOSITIONAL COMMUNICATION SYSTEMS

M. A. Sokolov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 71–76 refs (See N66-34446 20-07) CFSTI: $4.00

The conditions for an optimum program of multi-alternating detection in multi-positional communication systems are described. These conditions make it possible to find an optimum structure for the receiver in any position of the system

with any number of classes of the transmitted signal, if the detection program of the other positions is specified. H.S.W.

N66-34461# Joint Publications Research Service, Washington, D. C.

AN ANALYSIS OF ADDRESS SYSTEMS USING MULTIDIMENSIONAL SIGNALS

L. Ye. Varakin and I. M. Pyshkin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 77–82 refs (See N66-34446 20-07) CFSTI: $4.00

The effect of the intercorrelating properties of the signal of individual addresses on the level of the inter-address interferences is examined. Additionally the analysis takes into account the noises at the input, and the interferences between the addresses. A solution is given to the problem of determining the possible number of addresses, depending on the base of the multidimensional signals, the level of mutual interference, and noise. H.S.W.

N66-34462# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF INFORMATIONAL PROPERTIES OF MULTICHANNEL SYSTEMS OF DETECTION OF WEAK SIGNALS IN NOISES, BASED ON THE THEORY OF COINCIDENCES OF CONTINUOUS RANDOM FUNCTIONS

Ye. F. Babushkin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 83–90 refs (See N66-34446 20-07) CFSTI: $4.00

Based on the theory of coincidences of continuous random functions, the level of false alarms is analyzed in multichannel detecting systems in which discrete storing is accomplished by counting the overshoots of the output signals. Expressions are given which are valid when the random process and its first derivative are independent in each channel. Relationships are shown between the average frequency of false alarms and the restricted level for different numbers of channels. It is noted that an increase in the number of channels reduces the maximum frequency of false responses with respect to the average level of false alarms in a one-channel system; however, the determination of the relationship between the frequency of useful responses and the signal-to-noise ratio is simplified if a signal is present only in one channel. H.S.W.

N66-34463# Joint Publications Research Service, Washington, D. C.

FOUR-PARAMETER DISTRIBUTION OF SIGNAL'S AMPLITUDE AND PHASE-GENERALIZED DISTRIBUTION FOR RADIO CHANNELS WITH RANDOM-CHANGING PARAMETERS

D. D. Klovskiy and I. M. Samusenko *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 91–96 refs (See N66-34446 20-07) CFSTI: $4.00

It is assumed that the input of a radio channel is supplied with a harmonic signal, and the overall action of physical causes responsible for the fading of the harmonic signals in actual channels is characterized by a random complex transmission factor. With these assumptions, the distributions for the module and the argument of a complex transmission factor of a channel, where its orthogonal components are generally distributed normally, are obtained. H.S.W.

N66-34464# Joint Publications Research Service, Washington, D. C.

POTENTIAL NOISEPROOF FEATURES IN CHANNELS WITH FOUR-PARAMETRIC DISTRIBUTION OF SIGNAL'S AMPLITUDE AND PHASE

D. D. Klovskiy and I. M. Samusenko *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 97–102 refs (See N66-34446 20-07) CFSTI: $4.00

In a previously developed theory it was shown that for channels with random changing parameters, the distributions become more general by introducing four-parametric distributions for the amplitude and phase. It is shown that a coherent reception can be realized if the mathematical expectancies are not equal to zero and are known at the point of reception. Additionally the probability of error during an optimum reception for systems with an active interval is considered. H.S.W.

N66-34465# Joint Publications Research Service, Washington, D. C.

THE USE OF DEPENDENT TESTS FOR OPTIMIZING PLANNED SYSTEMS IN ACCORDANCE WITH A STATISTICAL INDICATOR

Yu. G. Pollyak *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Theory of Inform. 9 Aug. 1966 p 103–105 refs (See N66-34446 20-07) CFSTI: $4.00

The development of investigations on the use of dependent tests in probability modelling of complex systems is discussed. It is noted that the principle operation in optimizing consists of calculating the difference between the indicators corresponding to the values of the system's parameters and not a calculation of the absolute values of the indicator. This idea is developed in more detail, as it applies to one of the versions of the gradient method of optimizing. H.S.W.

N66-34515# Tufts Univ., Medford, Mass. Dept. of Mechanical Engineering.

A STUDY OF ACOUSTICAL MULTIPATH SYSTEMS. SECTION I: THEORY AND PROGRAM Final Report

Dwight W. Batteau 1 Jun. 1966 8 p
(Contract Nonr-494(00))
(AD-634378) CFSTI: HC $1.00/MF $0.50

The report investigates the effects of multiple paths on acoustical signals as related to speech recognition and improvement of signal-to-noise ratios. The basic theoretical structure being applied to the effects of multiple acoustical paths is derived principally from information theory and its associated field of transformations as encodings.

Author (TAB)

N66-34516# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

THE USE OF TRANSIENT AND IMPULSE RESPONSE APPROXIMATIONS IN ELECTROMAGNETIC SCATTERING PROBLEMS Scientific Report No. 3

Edward M. Kennaugh and David L. Moffatt 28 Feb. 1966 61 p refs *Its* Rept.-1793-3
(Contract AF 19(628)-4002)
(AFCRL-66-254; AD-634297) CFSTI: HC $3.00/MF $0.75

General properties of the solutions to transient electromagnetic scattering problems are described. electromagnetic field waveforms produced by the scattering of transient plane waves from finite objects are related to those produced by an impulsive plane wave. Properties of the impulse response waveforms at great distances from the target, particularly in

the backscattering direction, are discussed. Various methods for approximation of impulse response waveforms using time and frequency domain concepts are suggested and illustrated. Other applications of response waveforms to target identification and to prediction of radar echo pulse waveforms are described. Author (TAB)

N66-34546# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BULLETIN OF STATIONS OF OPTICAL OBSERVATION OF ARTIFICIAL EARTH SATELLITES

13 Jan. 1966 57 p refs Transl. into ENGLISH of Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov. Zemli (USSR), no. 35, 1963 p 1–34

(FTD-MT-64-532; AD-633667) CFSTI: HC $3.00/MF $0.75

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N66-34547# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EVALUATING THE ACCURACY OF VISUAL OBSERVATION OF STATIONS OF THE USSR FROM DATA OF OBSERVATIONS OF SATELLITE 1960 ϵ_3 IN 1961

M. A. Lur'ye and N. L. Shkol'nikova *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 1–6 (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

Deflections of calculated and observed positions for the Soviet Epsilon$_3$ satellite, launched in 1960, were evaluated on a Ural-1 digital computer. Considered were the mean orbital elements of the satellite; visual observations at given times and equatorial coordinates; and astronomical coordinates supplied by the stations. The various elements and stages of the program are given, and the observation methods of the stations are explained. Error data are analyzed for each station and the entire tracking network. The probability of errors occurring due to irregularity of observation or confusion with another satellite is pointed out in conclusion. K.W.

N66-34548# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF VISUAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES AT THE SATELLITE OBSERVATION STATION OF CHERNOVITSKIY UNIVERSITY

V. M. Kondratenko and Ye. A. Pavlyniv *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 7–11 (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

The organization of observer teams, instruction of personnel, and the reporting methods are described. Operation of the TZK telescope used for the observations is explained. Briefly mentioned are the communications equipment, the time recording system, astronomical reference material, and the procedure for satellite intersection. The recording and evaluation of intersections is described in detail. K.W.

N66-34549# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INDIVIDUAL DIFFERENCES DURING OBSERVATION OF SATELLITES

V. Merkushev *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 12–16 refs (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

A photoelectric instrument for improving the accuracy of recording a passing satellite is described. Purpose of the instrument is the elimination of individual differences in observation. A formula for determining individual differences, to be used in connection with the instrument, is given. The performance of six observers is analyzed, and the results are given in tabulated form. Practical results of error correction in satellite observation are also cited. It is concluded that individual difference calculations will increase the accuracy of satellite coordinate determination when used with the tube AT-1 and with the multiple intersection method. K.W.

N66-34550# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF VISUAL OBSERVATION OF ARTIFICIAL EARTH SATELLITES AT THE YEREVAN STATION

B. Ye. Tumanyan *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 17–19 (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

A method for reducing error in the plotting of an earth satellite's position is briefly explained. The method is specifically intended for use with the tube AT-1. Mounting and position fixing of the tube for satellite intersection are described, and an improved method for graphic recording of coordinates is mentioned. The degree of accuracy achieved with this method for satellite plotting is better than 0.1°. K.W.

N66-34551# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIENCE OF PHOTOGRAPHING SATELLITES BY A NAFA-21 CAMERA

V. A. Merkushev *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 20–22 (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

Major characteristics, loading, and operation of the camera are outlined. A schematic of the electric circuit is included. Mounting of the camera is briefly explained, and the tube AT-1 is recommended as searcher tube. Performance of the camera in taking photographs of the Echo satellite is discussed; star traces up to the tenth magnitude were obtained. K.W.

N66-34562# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT INCREASED ACCURACY OF PROCESSING PHOTOGRAPHS OF ARTIFICIAL EARTH SATELLITES, OBTAINED WITH A SMALL CAMERA

A. L. Chikarenko and S. A. Filipcheva *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 23–32 refs (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

The "Leningrad" camera, used in connection with the AT-1 tube, is discussed, and the advantages of its synchronic contact and automatic film transport are pointed out. The shutter mechanism and two objectives that were used with the camera are described. A brief evaluation is presented of film and camera performance. A method for determining the coordinates of an object from two stellar reference points is discussed, and a formula for such a determination is given. Error data were analyzed and compared with catalog data. A table listing times and coordinates of photographs that were taken is included. K.W.

N66-34564# Navy Electronics Lab., San Diego, Calif.

RADAR-SIGNALS CONVERTER Research and Development Report, Sep. 1965–Jan. 1966

R. A. Turner 22 Apr. 1966 25 p refs

(NEL-1373; AD-634742) CFSTI: HC $1.00/MF $0.50

An equipment has been developed at NEL that combines radar video and trigger signals for recording and separates them for playback. It minimizes noise-generated false trigger signals in manual and automatic noise-rejection modes of operation. With another module, an NEL synchro-tape-synchro converter, the radar-signals converter transforms the RCA TR4-CVR television recorder previously procured by NEL into a radar recorder. Author (TAB)

N66-34568# Library of Congress, Washington, D. C. Aerospace Technology Div.

A METHOD OF INCREASING DIGITAL DATA TRANSMISSION SPEED

Boris Doncov *In its* Foreign Sci. Bull., Vol. 2, No. 8 Aug. 1966 p 4–6 refs (See N66-34566 20-34)

A discrete data coding method related to A. Lender's duobinary technique is described which compresses the baseband spectrum of a binary signal by a factor of three. The coding exhibits the same noise immunity as is characteristic of the duobinary technique. Inherent in the process of coding is an error detection feature which does not depend on data redundancy. Author

N66-34571# Library of Congress, Washington, D. C. Aerospace Technology Div.

VLF TRANSMISSION THROUGH THE IONOSPHERE

In its Foreign Sci. Bull., Vol. 2, No. 8 Aug. 1966 p 26–28 refs (See N66-34566 20-34)

An effort to find a solution for transmission and reflection of low-frequency electromagnetic waves through a magnetoactive ionospheric plasma was made by using an optical model to obtain the transmission coefficients. It was assumed that plasma parameters varied only in the vertical direction, that a plane wavefront signal was generated vertically, and that the effects of ionic and molecular motion were negligible. The derived equations were integrated at frequencies from 1.5 to 100 kc and the electron density and effective collision frequency as function of altitude was developed. Resulting transmission coefficients for both, day and night, transmission conditions demonstrated some discrepancies at low frequencies. It was concluded that absorption of ordinary wave components by the ionosphere was so great that the above described method is not feasible. G.G.

N66-34572# Library of Congress, Washington, D. C. Aerospace Technology Div.

BROADBAND DIPOLE ARRAY WITH AN ACTIVE REFLECTOR

In its Foreign Sci. Bull., Vol. 2, No. 8 Aug. 1966 p 29–31 refs (See N66-34566 20-34)

A unidirectional cophased dipole antenna array with an active reflector fed by a directional coupler is analyzed. It is shown that, with certain chosen parameters (coupling coefficient, dipole and feeder characteristic impedances), this antenna maintains high directivity with good matching and efficiency characteristics in a wide frequency band without readjustments. Author

N66-34578# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON ANTENNAS

A. R. Vol'pert, ed. 9 Aug. 1966 54 p refs Transl. into ENGLISH from the publ. "XXII Vsesoyuznaya Nauchnaya Sessiya. Posvyashchennaya Dnyu Radio—Sektsiya Antennykh Ustroystv" Moscow, 1966 p 3–40

(JPRS-36908; TT-66-33338) CFSTI: $2.00

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N66-34579# Joint Publications Research Service, Washington, D. C.

SYNTHESIS OF LINEAR ARRAYS AND SOME PROBLEMS OF THE UNIFORM APPROXIMATION OF THE ASSIGNED DIRECTIONAL PATTERN IN THE INTERVAL OF REAL ANGLES

V. I. Yelumeyev and V. I. Popovkin *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Antennas 9 Aug. 1966 p 1–7 refs (See N66-34578 20-07) CFSTI: $2.00

This synthesis problem is to construct a discrete antenna of electrical length, the complex factor of which uniformly approximates the assigned directional pattern in the interval of real angles. The triangle inequality is utilized to estimate the modulus of the interpolating function in the equality in order to obtain the final expression for the departure value of the synthesized array factor from the assigned directional pattern and to estimate its structural properties. G.G.

N66-34580# Joint Publications Research Service, Washington, D. C.

ABOUT THE SYNTHESIS OF A CAVITY ANTENNA WITH AN ASSIGNED DIRECTIONAL PATTERN

A. G. Ramm *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Antennas 9 Aug. 1966 p 8–13 refs (See N66-34578 20-07) CFSTI: $2.00

The problem is considered of finding for the exciters a spatial distribution which corresponds to the assigned directional pattern. It is proved that the distribution of the exciters is uniquely determined by the directional pattern. A set of functions is described which are directional patterns for the distribution of the exciters and are concentrated in a limited portion of space. The procedure is presented for finding the distribution of the exciters on the basis of the directional pattern. If the vector properties of the field are taken into consideration, then in general the directional pattern does not determine uniquely the distribution of the exciters. Author

N66-34581# Joint Publications Research Service, Washington, D. C.

ABOUT ONE CASE OF DISCONTINUOUS IMPEDANCE BOUNDARY CONDITIONS WITH SPATIAL DISPERSION

G. A. Ponomarev *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Antennas 9 Aug. 1966 p 14–21 refs (See N66-34578 20-07) CFSTI: $2.00

Considered was the conformity of an equivalent impedance model with its boundary conditions on the surface of concrete structures. The magnetic component of the incident plane electromagnetic wave mode was defined and its integral representation developed by Fourier transform to represent the boundary conditions for an infinite dielectric layer on the investigated structure. G.G.

N66-34582# Joint Publications Research Service, Washington, D. C.

DIFFRACTION OF A PLANE ELECTROMAGNETIC SURFACE WAVE INCOMING AT AN ARBITRARY ANGLE TO A DISCONTINUITY OF THE SURFACE IMPEDANCE

V. L. Mironov and V. G. Myshkin *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Antennas 9 Aug. 1966 p 22–29 refs (See N66-34578 20-07) CFSTI: $2.00

The diffraction of oblique electromagnetic waves on a rectilinear discontinuity in the isotropic surface impedance of an infinite plane is studied by expansion of the radio wave shore theory to the case of complex impedances, arbitrary with respect to the value of the modulus. The solution to the problem is then generalized to encompass the case of arbitrary angles of incidence, and to a vector analog for the synthesis of linear arrays in the interval of real angles. G.G.

N66-34583# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF REFLECTIONS IN ELLIPTICALLY POLARIZED ANTENNAS UPON THE POLARIZATION OF THEIR RADIATION FIELD

Yu. V. Shubarin, N. N. Gorobets, and V. A. Voloshin *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Antennas 9 Aug. 1966 p 30–38 refs (See N66-34578 20-07) CFSTI: $2.00

Antennas with phasing sections were studied by approximating the polarization of the antennas radiation field and the influence that the reflections, that arise from the aperture of the exciter and from the reaction of the reflector upon the exciter, have on the polarization of the radiated field. Computation results showed that the lapse of ellipticity due to reflections from the aperture was significant for waveguide exciters and insignificant for a horn exciter; the higher the gain factor of the exciter and the smaller the focal length of the reflector was in relation to the wavelength, the greater was the drop in ellipticity. It was concluded that reflections from the exciter's aperture changed ellipticity through circular polarization in the phasing section, and that the reflector's reaction upon the exciter significantly reduced the ellipticity of the entire antenna when the phasing section was adjusted for circular polarization. G.G.

N66-34584# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF A STEERABLE SLOTTED WAVEGUIDE ANTENNA WITH AN INVERTED-L CROSS SECTION

Yu. V. Shubarin, V. A. Lyashchenko, and P. Sadymak *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Antennas 9 Aug. 1966 p 39–45 refs (See N66-34578 20-07) CFSTI: $2.00

The present work investigates a steerable slotted waveguide antenna with an inverted-L cross section. The shifting of the major lobe is accomplished by the change in the electrical distance between slots by means of a longitudinally magnetized ferrite rod placed under the slots in the waveguide. The constant magnetic field is created by two electric magnets. The use of an inverted-L waveguide gives a compact and convenient design for the slotted waveguide antenna, because the electric magnets can be placed in the cavities of the inverted-L waveguide. Author

N66-34587# Mitre Corp., Bedford, Mass.

COMPARISON OF GENERAL PERTURBATIONS AND SPECIAL PERTURBATIONS EPHEMERIDES

Edward H. Larson and James B. Frazer Jun. 1966 26 p refs (Contract AF 19(628)-5165)

(MTR-22; ESD-TR-66-119; AD-635137) CFSTI: HC $4.00/MF $0.50

The accuracy of the Spacetrack General Perturbations program over short periods is evaluated for a number of cases. They show that oscillatory terms resulting from drag perturbations contribute heavily to errors at low altitudes, and that these terms must be eliminated if the first order theory is to be used for high accuracy in these circumstances. It appears that the evaluation technique employed would be useful in addressing a number of other problems; several promising applications are discussed. Author (TAB)

N66-34599# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME PRACTICAL CONSIDERATIONS FOR REDUCING THE SURFACE RESISTIVITY OF X-BAND COMPONENTS
Alan H. Kessler 13 Jun. 1966 58 p refs *Its* Tech. Note 1965-41 Revised
(Contract AF 19(628)-5167)
(ESD-TR-66-242; AD-636472) CFSTI: HC $3.00/MF $0.75

In an experimental study program involving X-band waveguide components, various factors affecting rf resistivity were investigated. Specific results of this investigation included: (1) the successful reduction of the rf resistivity of conventional beryllium copper castings by electroplating with higher conductivity metals, (2) decreasing rf resistivity by lowering surface roughness, (3) the attainment of microwave components cast from a higher conductivity casting alloy than beryllium copper, (4) lowering of the rf resistivity by minimizing the effects of surface oxides and sub-surface contaminants, (5) the use of OFHC and electroformed copper components to achieve low resistivity, and (6) an evaluation and comparison of dielectric and metallic protective coatings which inhibit the deterioration of waveguide surfaces. Author (TAB)

N66-34615# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MICROWAVE ANTENNA RELATIVE GAIN MEASUREMENTS IN A PARTIALLY COHERENT FIELD
Rudolph J. Dichtl (M.S. Thesis) Jun. 1966 113 p refs
(GSP/PH/66-4; AD-633728) CFSTI: HC $4.00/MF $0.75

Relative gain and resolution measurements of a microwave antenna in a partially coherent field were made. The degree of coherence function for a rectangular aperture incoherent source was also measured. A resonant longitudinal slot array antenna with a center frequency of 2.8 GHz was constructed. The partial coherent microwave field was generated by an incoherent source which consisted of a planar array of commercial fluorescent lamps. A tuned radio frequency (TRF) radiometer was used in conjunction with a lock-in amplifier as a synchronous detection system. The experimentally measured degree of coherence function agreed well with theory. The results of the antenna measurements indicated that only a limited improvement in gain and resolution could be obtained by increasing the aperture dimensions for an antenna in a field of a known degree of partial coherence. Author (TAB)

N66-34616# Syracuse Univ. Research Inst., N. Y.
INVESTIGATION OF GROUND ANTENNA CHARACTERISTICS Final Report, 1 Feb. 1962-31 Jan. 1966
David K. Cheng Griffiss AFB, N. Y., RADC, May 1966 32 p refs
(Contract AF 30(602)-2648)
(EE957-6603F; RADC-TR-66-208; AD-635100) CFSTI: HC $2.00/MF $0.50

The purpose of this work was to conduct theoretical study, mathematical analysis and experimental verification of research-type problems related to the advancement of the state-of-the-art in the field of antenna for ground-based applications. Sixteen individual tasks were completed in technical areas related to array antennas, transmission lines, electromagnetic wave scattering and field measurements. Typical tasks in these areas include: studying the effects of removal of elements on array antenna radiation patterns; developing design techniques for reducing side lobe radiation in linear and planar arrays; examining and minimizing VSWR caused by multiple discontinuities in transmission lines; experimentally examining mutual coupling effects in arrays; and developing a new technique for measuring diffraction fields. Work accomplished on each task undertaken during the course of this investigation has been published in separate technical reports and is summarized in this report. Individual task reports should be consulted for technical details. TAB

N66-34617# Huyck Systems Co., Huntington Station, N. Y.
IN-FLIGHT TERRAIN AND RADAR SIMULATOR Final Report, 29 Jun.-9 Nov. 1965
M. Feler Ft. Monmouth, N. J., Army Electron. Command, Apr. 1966 31 p
(Contract DA-28-043-AMC-01615(E))
(ECOM-01615-F; AD-635485) CFSTI: HC $3.00/MF $0.50

The in-flight terrain and radar simulator (TARS), is an airborne electronic system capable of accepting inputs of Doppler velocity, altitude above an arbitrary reference level and antenna reference angle. The outputs consist of a simulated forward scanning radar, (main bang and radar return), terrain profile, radar altitude and antenna scan angle. The report describes the design concept and input-output functions of TARS. Accuracies, signal generation as well as a general system discussion are included in the text. Methods for extending terrain storage and terrain computation range are included. Author (TAB)

N66-34638*# Alabama Univ., University. Systems Engineering Group.
STATISTICAL QUALITY CONTROL APPLIED TO A TELEMETRY SYSTEM ACCEPTANCE PROCEDURE Technical Report No. 13
Marvin A. Griffin, Richard S. Simpson, H. Paul Hassell, Jr., and William S. Spivey Jun. 1966 117 p refs
(Contract NAS8-20172)
(NASA-CR-77305) CFSTI: HC $4.00/MF $1.00 CSCL 09F

The purpose of this report is to develop a methodology for implementing statistical control charts as a basis for telemetry package acceptance procedures. The methodology is developed for both the control chart for mean values and for the control chart for standard deviations. A total expected cost model which relates alpha and beta errors as well as the sample size is developed. This model is used to establish optimum upper and lower control limits for the chart for mean values. Control limits for the chart for standard deviations are then established based on this model. An experiment that was designed and conducted for the purpose of testing the feasibility of the optimum control limits is reported. Results of this experiment confirm the reasonableness of the assumptions made in the cost model. Subcarrier oscillators in the experimental telemetry package that were intentionally maladjusted are detected by the control charts. Estimates of the accuracy and precision of the telemetry package are obtained and ninety-nine percent confidence limits are established for these limits. Author

N66-34634*# Radiation Systems, Inc., Alexandria, Va.
A HIGH-GAIN OMNIDIRECTIONAL SATELLITE ANTENNA TECHNIQUE Final Report
George G. Chadwick, J. E. Hill, and P. Kerr 3 Sep. 1965 146 p refs
(Contract NAS5-3947)
(NASA-CR-77236; TR-68) CFSTI: HC $4.00/MF $1.00 CSCL 09F

Details are given on an antenna technique suitable for use in spaceborne vehicles. The system consists of a 12-element planar multiple beam array, and a 4×16-element multiple beam circular array. Solid state switching networks are used to reduce the multiple beam ports to a single rf terminal. In the planar array, the individual spiral radiator elements are arranged to form three-element building blocks rather than the four-element building blocks used in more conventional multiple beam systems. The characteristics of the system are described, and the antenna system block diagram is defined. The theory and design of the components and major subcomponents are discussed, along with

the mechanical packaging of the system. System performance data are analyzed for the 16-element multiple beam circular array, the 12-element planar array, and the interpositioned four-element array. It was concluded that the antenna data are in generally good agreement with computed data, and that the interpositioning technique improves the gain at the crossover regions by approximately 1.2 to 1.7 dB. M.G.J.

N66-34702*# Sperry Phoenix Co., Ariz.
STUDY OF APPLICATIONS OF A TRACKING FILTER TO STABILIZE LARGE FLEXIBLE LAUNCH VEHICLES Final Technical Report
David C. Cunnigham and Robert L. Schaeperkoetter May 1966 217 p
(Contract NAS8-20080)
(NASA-CR-77353; LJ-1201-0609) CFSTI: HC $6.00/MF $1.25 CSCL 09F

The static and dynamic characteristics of the adaptive tracking filter were determined. Dynamic analysis of the frequency adjustment loop showed that the response of the filter natural frequency to a small change in input frequency is essentially that of a first order lag network. Static analysis included the determination of output harmonics for both single and multiple frequency inputs. A detailed analysis was made of the multiple frequency input case to determine the frequency tracking error and the frequency discrimination of the system. A basic control system using first and second mode filters was developed. Fixed point trajectory studies demonstrated that both of configurations are capable of providing the required stabilization for nominal first and second bending mode parameters. A real time trajectory simulation study was conducted. The results of both analytical and simulation studies verified that the objective of gain- and phase-stabilizing the first two bending modes of the launch vehicle was accomplished. N.E.N.

N66-34794*# Auburn Research Foundation, Inc., Ala.
THE DESIGN OF A HYBRID-TYPE S-BAND DIODE PHASE SHIFTER Technical Report No. 1
E. R. Graf 16 May 1966 69 p refs
(Contract NAS8-20557)
(NASA-CR-77420) CFSTI: HC $3.00/MF $0.75 CSCL 09F

A ring-hybrid microwave (S-band) phase shifter providing quantized phase shifts has been designed, fabricated, and tested. The smallest phase shifting increments of 22.5° were, at the time of the design, the smallest increments yet available. This ring-hybrid design makes possible additional small phase shift increments without significant increase in loss. The phase shift element consists of a PIN diode, a transformer, and a length of open transmission line acting as a reactive element for tuning. The Smith Chart was used to design the desired phase increments, and criteria were developed for optimum circuit design of the elements. The strip-line design technique permits compensation for diode manufacturing variations. Cost is held to a minimum by use of relatively low-cost diodes. To verify these design criteria, a four-bit diode phase shifter for 1.8 GHz was constructed. The phase shifter, which consisted of a 180°, a 90°, a 45°, and a 22.5° phase bit, was constructed such that phase shifts of 360° in 22.5° increments are available. The insertion loss proved to be approximately 1.2 db with a nominal voltage standing-wave ratio of 1.25:1. Author

N66-34809# Illinois Univ., Urbana. Electrical Engineering Research Lab.
IONOSPHERIC RESEARCH Tenth Quarterly Progress Report, 1 Jan.-31 Mar. 1966
H. D. Webb Jun. 1966 58 p refs
(Contract DA-36-039-AMC-03703(E))
(ECOM-03703-10; AD-634729) CFSTI: HC $3.00/MF $0.75

Moon-reflected signals were received on 150.6 mc and 413.25 mc on 36 days during the quarter. Data have not been analyzed for correlations with magnetic and solar activity which occurred during the times of observation. A phase-lock receiver, designed to stay tuned to the incoming moon-reflected signals at 150.6 mc, is working well. Small errors in antenna position, both at the transmitter and at the receiver, lead to errors in Faraday rotation angle at 413.25 cm, which can cause erroneous resolution of the n × 180° ambiguity. When observations are made for one or two hour periods these errors tend to cancel. A thesis for the M.S. degree dealing with the design of circularly polarized antennas for 150 mc, is appended. Author (TAB)

N66-34904# Federal Scientific Corp., New York.
MODEL 254C SIMORAMIC. DOUBLE-SPECTRUM (CEPSTRUM) ANALYZER FOR EXTRACTION OF PITCH DATA Final Report, Sep. 1964-Sep. 1965
Mark R. Weiss 15 Feb. 1966 134 p refs
(Contract AF 19(628)-4389)
(FSC-F/148; AFCRL-66-145; AD-635488) CFSTI: HC $4.00/MF $1.00

A new technique of pitch extraction has been implemented which makes use of the double spectrum analysis of speech signals. In contrast to previous applications of this method extracting pitch, the system described here operates in real-time and does not require the use of a computer. In this implementation, the waveforms of speech spectra, obtained by use of a Model 254 SIMORAMIC Spectrum Analyzer, are scanned by an analyzer of the stepped-filter type to obtain the desired pitch values. Tests of this instrument show that it provides reliable pitch data even when the signal-to-noise ratio is very poor and the fundamental component of voiced speech is missing. Spurious signals such as hum and narrow band noise, even when much greater than the speech signal, do not effect the accuracy of pitch extraction. The analyzer potentially is capable of detecting and extracting pitch data for multiple talker inputs. Author (TAB)

N66-34917# Polytechnic Inst. of Brooklyn, N. Y. Electrophysics Dept.
RESEARCH STUDY IN DIGITAL COMMUNICATION CODES Final Report, 1 Dec. 1963-30 Nov. 1964
Arthur E. Laemmel Feb. 1966 84 p refs
(Contract DA-36-039-SC-89219)
(PIBMRI-1298-65; AD-635145) CFSTI: HC $3.00/MF $0.75

Digital codes for information compression are studied, together with some related topics in theory of sequential machines. The material is written in eight sections which will provide a systematic organization for a possible book on the subject. Conjectures and problems are given at several points where it is believed further research will yield useful theorems. Some of the results obtained apply to general digital transformations (not just compression), but little emphasis is placed here on error reduction. Author (TAB)

N66-34942# Army Electronics Labs., Fort Monmouth, N. J. Communications and Automatic Data Processing Lab.
CODING STUDIES OF REAL CHANNEL DATA BY COMPUTER SIMULATION
Edward D. Moyes and Robert W. Taylor, Jr. May 1966 78 p refs
(ECOM-2701; AD-635009) CFSTI: HC $3.00/MF $0.75

Block codes have not obtained the error correction capabilities as originally predicted since most error bits are highly correlated to adjacent bits; therefore, errors have a tendency to occur as bursts rather than random errors. The interleaving concept makes these bursts appear as random errors; hence, the errors can be corrected by block codes. Data collected over an ionospheric path from Davis, California, to Deal, New Jersey, was used with computer simulation to determine an optimum interleaver size and an optimum block code that could be used for this particular path. Author (TAB)

N66-34979# Electro-Voice, Inc., Buchanan, Mich.
LIGHTWEIGHT AUDIO ACCESSORIES Third Quarterly Report, 1 Jan.–31 Mar. 1966
B. T. Cochran May 1966 17 p *Its* Rept.-3
(Contract DA-28-043-AMC-01542(E))
(ECOM-01542-3; AD-635500) CFSTI: HC $1.00/MF $0.50

The report contains a summary of the work performed for the design and construction of a lightweight and miniature type handset, hand held microphone, double earphone headset and telegraph key. This report also contains a review of the work performed in this period which consisted of electrical and electroacoustical tests and finalizing of design in order to obtain tooling and materials for the twenty each engineering development models of these accessories. Author (TAB)

N66-34985# Michigan Univ., Ann Arbor. Radiation Lab.
STUDIES IN RADAR CROSS SECTIONS L–DIFFRACTION AND SCATTERING BY REGULAR BODIES. IV: THE CIRCULAR CYLINDER Scientific Report No. 3
Olov Einarsson, Ralph E. Kleinman, Pushpamala Laurin, and Piergiorgio L. E. Uslenghi Feb. 1966 330 p refs *Its* Rept.-7133-3-T
(Contract AF 19(628)-4328)
(AFCRL-66-182; AD-635186) CFSTI: HC $7.00/MF $1.50

A survey of electromagnetic and acoustical scattering by a circular cylinder is performed. Theoretical methods and results for infinite and semi-infinite cylinders, and experimental ones for finite cylinders, are included. Only time-harmonic fields are considered, and dielectric cylinders are not taken into account. Author (TAB)

N66-35003# Cutler-Hammer, Inc., Deer Park, N. Y. Airborne Instruments Lab.
OFFSET MARKER BEACON ANTENNA Final Report
George Skahill Feb. 1966 21 p
(Contract FA-WA-4523)
(SRDS-RD-65-88)

The development, construction, and test of the offset instrument landing system marker beacon antennas are described. Three antenna configurations were necessary for operation at offset distances of one-quarter mile, one-half mile, and three-quarters to one mile. Each configuration consists of a broadside array of Yagi-Uda end-fire radiators. The basic configuration is a seven-element array for operation at an offset distance of three-quarters to one mile. The basic configuration can be modified to a four- and two-element array for operation at one-half and one-quarter mile, respectively. Measurements on the configuration showed that the antenna performance was consistent with the design requirements. The antenna features most essential for reliable offset marker system operation are a well defined main beam, a beamwidth sufficient to give proper marker light duration, and an extremely low side-lobe level that precludes the possibility of spurious light response. The desired side-lobe level can be obtained if the local environment is reasonably flat and free of obstacles. Author

N66-35007# Radiation, Inc., Melbourne, Fla.
STUDY OF ANTENNA PATTERN SYNTHESIS Final Report, Jan. 1964–Jun. 1966
Donald R. Rhodes 15 Jun. 1966 14 p refs
(Contract AF 19(628)-4007)
(AFCRL-66-420; AD-635535) CFSTI: HC $1.00/MF $0.50

An investigation into the foundations of the theory of solid-angle pattern synthesis for planar antennas is reviewed. The principal results include a fundamental principle in the theory of planar antennas, the development of properties of a class of doubly orthogonal functions that are the most natural for representing both aperture and pattern functions, and the derivation of formulas for stored magnetic and electric energies needed to constrain the synthesis solution to ensure physical realizability. Author (TAB)

N66-35038# Royal Aircraft Establishment, Farnborough (England).
A VOLTAGE CONTROLLED OSCILLATOR FOR THE UK-3 SATELLITE TELEMETRY
W. H. E. Hampton Dec. 1965 24 p refs
(RAE-TR-65293) CFSTI: HC $1.00/MF $0.50

A voltage-controlled oscillator for the UK-3 satellite is described. The circuit is based on that used by the National Aeronautics and Space Administration organisation for UK-2. The factors which affect the input sensitivity and frequency stability are indicated. The changes made to the original circuit used in UK-2 are described, together with methods for increasing reliability by the use of planar transistors throughout. Author

N66-35073# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF PROPAGATION OF SHORT-WAVE SIGNALS BY THE CHARACTERISTIC DISTORTIONS AT THE POINT OF RECEPTION
N. A. Tel'pukhovskiy 16 Feb. 1966 19 p ref Transl. into ENGLISH from Trans. of the 15th Astrometric Conf. of the USSR, Pulkovo, 13–17 Dec. 1960, Acad. of Sci. of the USSR, Moscow, 1963 p 365–373
(FTD-MT-65-168; AD-635273) CFSTI: HC $6.00/MF $0.50

The possibility of determining the propagation time of shortwave station signals by means of characteristic distortions at the reception point is considered. The distortions are due to the summation of signals, which travelled paths of different length, at the reception point. The comparison of the method of determination of propagation time from measurements of the propagation time differences of separate signals with that of two-sided measurements showed satisfactory agreement. In order to facilitate such measurements it is proposed that short (0.1–0.2 msec) impulses be included in the signal transmission program. It is shown that Stoyko's empirical formulas for the computation of propagation time give too high values if the signals are registered by the oscillographic method. Author (TAB)

N66-35116# Institute for Defense Analyses, Arlington, Va. Research and Engineering Support Div.
A COMPARISON OF THREE MODELS FOR SEQUENTIAL OBSERVATIONS IN SONAR DETECTION
Donald L. Iglehart Mar. 1966 27 p refs
(Contract ARPA SD-50)
(P-252; IDA/HQ-66-4881; AD-635394) CFSTI: HC $2.00/MF $0.50

The paper compares three mathematical models which have been proposed to describe the sonar detection problem

in the case of sequential observations. The first model assumes complete independence between observations. The second model assumes a constant dependence between observations, independent of the time between observations. Finally, the third model assumes a dependence between observations which decays exponentially as the time between observations increases. These models have been presented in a consistent and unified manner to facilitate comparison, as would be expected. The independent model requires uniformly smaller signal-to-noise ratios for any probability of detection than the other two models and the third model requires uniformly smaller signal-to-noise ratios than does the second model. However, in the range of detection probabilities 0.3–0.7, the maximum increase in signal to-noise ratio required for the constant correlation model over the exponentially decaying model is less than 14 percent. Author (TAB)

N66-35126# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

ANALYSIS OF A WIDEBAND RANDOM SIGNAL RADAR SYSTEM

George R. Cooper and Ronald Lee Gassner Aug. 1966 132 p refs

(Grant NSF GK-189)

(TR-EE66-9)

This study is concerned with the analysis of a radar system transmitting a signal from a wideband random noise process and employing a correlation receiver to estimate target range and range rate. The correlator is a digital, polarity-coincidence correlator which preserves the wideband information by using very narrow sampling pulses, but which does not require high sampling rates. The digital polarity-coincidence correlator is analyzed in several configurations, using both digital and analog integration, and expressions for the output signal-to-noise ratio are developed in each case. The random signal radar is separable into range and range rate resolution functions, each of which is independent of the other. Author

N66-35169*# Auburn Research Foundation, Inc., Ala.

AUTOMATICALLY SCANNED ANTENNA SYSTEMS Final Report

H. M. Summer 20 Jan. 1966 131 p refs

(Contract NAS8-11251)

(NASA-CR-77443) CFSTI: HC $4.00/MF $1.00 CSCL 09F

The results of work efforts toward the development of requirements, design, fabrication, and testing of an antenna system suitable for use with Airborne Radar Orbital Determination (AROD) transponder stations, are given. A prototype of the direction finding system was constructed, and is being tested. An electronic phase shifter using PIN type diodes was also designed and constructed. The shifter provides phase shifts necessary to scan the antenna array in 22.5° increments. A solid state device to drive the phase shifters was also designed and tested. A switching system suitable for use with the electronic phase shifters is under construction. In addition, a prototype of the 6X6 scanning array at the receiving frequency of 2.214 GHz was constructed, and results of testing show that the radiation patterns correspond closely with theoretical predictions. L.S.

N66-35195# Radio and Space Research Station, Slough (England).

OPTICAL OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FOR THE MONTH OF MARCH 1966 AND SUPPLEMENTARY OBSERVATIONS FOR THE MONTHS OF JUNE 1962 AND FEBRUARY 1966

[1966] 49 p

CFSTI: HC $2.00/MF $0.50

Observational data of satellites and rockets are presented in tabular form. The data includes station, U.T. time, right ascension, declination, and magnitude. N.E.N.

N66-35200# Michigan Univ., Ann Arbor. College of Engineering.

ON THE HELMHOLTZ EQUATION FOR AN ACOUSTICALLY RIGID SCATTERER

Ergun Ar May 1966 68 p refs

(Grant NSF GP-4581)

(Rept.-7359-1-T)

An integral equation was derived for the exterior Neumann problem whose kernel is the potential Green's function of the second kind instead of the free space Green's function for the Helmholtz equation. Despite the fact that the integral operates over all space and the surface and it is really an integro-differential operator, the equation was solved for the wave numbers k (assumed complex) with sufficiently small modulus. The relation between the low frequency expansion and the Neumann–Liouville series for the solution is indicated. The procedure was then applied to the scattering of a plane wave of sound by an acoustically rigid sphere. Since the exact solution was known, a check (for the first three terms in the low frequency expansion) is provided. Some of the areas which were felt to be natural extensions of the problem are outlined, e.g., nonseparable surfaces (bodies with edges), radius of convergence of the low frequency expansion, vector (electromagnetic) problems, and two-dimensional low frequency scattering problems. L.E.W.

N66-35202# Joint Publications Research Service, Washington, D. C.

ACTIVITIES OF THE HUNGARIAN OBSERVATION NETWORK FOR ARTIFICIAL SATELLITES

Marton III 19 Aug. 1966 18 p Transl. into ENGLISH from Magyar Tudomany (Budapest), no. 5, May 1966 p 297–305 (JPRS-37127; TT-66-33556) CFSTI: $1.00

The artificial satellite observational activities of the network of approximately 300 stations is reviewed. The usefulness of the program is discussed. The coordinated operations with the Soviet countries is mentioned. The tracking instruments and their accuracy are described. The results and lectures on the data are summarized. N.E.N.

N66-35208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN EQUATIONS OF SWEPT FREQUENCY SPECTRUM ANALYZERS FOR IN-FLIGHT VIBRATION ANALYSIS

Edward F. Miller and David L. Wright Washington, NASA, Sep. 1966 34 p refs

(NASA-TN-D-3611) CFSTI: HC $2.00/MF $0.50 CSCL 09F

The equations for the design of swept frequency spectrum analyzers are presented with the intended application being in-flight analysis of vibration data. Primary emphasis is given to developing the optimum combination of the frequency-time function and the analyzing filter bandwidth. The main criterion used is minimum sweep time coupled with acceptable resolution and accuracy. Constant, linear, and second-order sweep rates are discussed, and the frequency-time equation is developed for each of these three types. The analyzer using a second-order sweep rate is shown to have the shortest sweep time, but it requires an expanding bandwidth filter and a decreasing averaging-time power detector.

The linear sweep rate analyzer is shown to require less bandwidth per channel and is much less complex. The constant sweep rate analyzer is shown to have either very long sweep times or poor frequency resolution; however, all three types of analyzers have bandwidth savings over real-time transmission of wide-band data. Author

N66-35233*# Alabama Univ., University. Systems Engineering Group.

ANALYSIS OF THE LINEARITY CHARACTERISTICS, TAPE RECORDERS AND COMPENSATION EFFECTS IN THE FM/FM TELEMETRY SYSTEM

Marvin A. Griffin, Richard S. Simpson, H. Paul Hassell, Jr., Michael K. Brown and John J. Jarvis Mar. 1966 145 p refs *Its* Tech. Rept.-11

(Contract NAS8-20172)

(NASA-CR-77503) CFSTI: HC $4.00/MF $1.00 CSCL 09F

The purpose of the linearity experiments was to determine if any non-linear effects existed within the system. Overall system tests indicated an affirmative answer. The degree of non-linearity was determined and a mathematical model which describes this effect was formulated. The experiments related to tape recorder effects resulted in the development of a methodology for isolating the errors associated with individual components of the system. A methodology for determining the error assignable to the instability of the system was also developed. The advantages offered by tape speed compensation are summarized. A possible explanation for the large interaction variance is discussed, as is the large contribution of the analog tape recorders to total system noise. Author

N66-35238*# Northrop Corp., Palos Verdes Estates, Calif. Nortronics Div.

ANALYTICAL AND EXPERIMENTAL INVESTIGATIONS INTO PROBLEMS ASSOCIATED WITH GYRO-STABILIZED PLATFORM-MOUNTED OPTICAL SENSING ELEMENTS Final Summary Report

E. H. Kong, Jr. and W. H. Schuck 15 Jul. 1966 205 p refs

(Contract NAS8-20193)

(NASA-CR-77502; NORT-65-126) CFSTI: HC $6.00/MF $1.25 CSCL 17H

The use of a star tracker with the ST124-M platform to provide long-term drift compensation is considered. The accuracy with which platform alignment can be made is determined for different platform–star tracker mounting configurations. The coordinate relationships between the star tracker triad, the inertial triad and the terrestial triad are presented, and the utilization of a star tracker, inertial platform and a horizon sensor for orbital navigation and attitude control are considered. Fundamental design concepts, including considerations of different optical systems, detectors of visible energy, and several optical modulation methods are presented. The utilization of optical equipment in a spacecraft is discussed, and three types of optical experiments, star tracker-platform, scientific and engineering experiments are evaluated. The causes and methods of reducing off-axis and background radiance in an optical system are examined. Some techniques considered include use of a sun shade or miltiple-celled sun shield, baffling, and the operation of the star tracker in a space environment. Author

N66-35308*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APOLLO INFRARED ACQUISITION AND TRACKING SYSTEM Summary Report

Herbert L. Richard Sep. 1965 148 p refs Submitted for Publication

(NASA-TM-X-57016; X-524-65-290) CFSTI: HC $4.00/MF $1.00 CSCL 17E

The Apollo Command Module reentry on return from a lunar mission will generate sufficient energy in the infrared band to permit daylight detection, acquisition, and tracking from an aircraft at a range of 500 nautical miles. The tracking information can be used to accurately predict the impact point. This function can be performed by a passive infrared system that requires no weight, power, or space from the spacecraft, and no large ship or real estate and associated large antenna investment. It is highly mobile and can quickly span continents and oceans to be on site during a spacecraft reentry. The system's range capability is calculated for the minimum temperature conditions which is reached about 10 seconds after reentry starts at 400,000 feet. Atmospheric effects, scattered sunlight, and atmospheric thermal emission present a background radiation with a minimum radiance across a 3 to 5 micron infrared band. The atmospheric transmission is high at the aircraft altitude of 35,000 feet. A cloud cover analysis over the Apollo reentry area at this altitude showed a minimal condition exists. A state-of-the-art review shows that infrared systems exist with the desired capability. Two conceptual designs are presented. Recommendations are presented and specifications for a system design are appended. R.N.A.

N66-35332*# National Aeronautics and Space Administration, Washington, D. C.

GIANT ANTENNA TO BE DEDICATED AT GOLDSTONE, CALIF.

26 Apr. 1966 23 p

(NASA News Release-66-88) Available from the Scientific and Technical Information Division CSCL 09F

Basic details are presented on the Goldstone antenna, which is considered to be one of the world's largest and most sensitive automatic space tracking and telemetry antennas. With a parabolic aluminum dish reflector 210 feet in diameter, the steerable antenna will be able to follow future Mariners and other spacecraft not only to Mars and Venus but to Pluto on the outer reaches of the solar system. Expected performance characteristics and operational data are given. The history and background of the Goldstone Space Communications Station, the primary station of the worldwide Deep Space Network, are reviewed, and a list of United States and foreign antennas is included. M.G.J.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-34166# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SCIENTIFIC TECHNICAL INFORMATION (SELECTED ARTICLES)

Ye. V. Paduchava 17 Mar. 1966 47 p refs Transl. into ENGLISH from Nauchn. Tekhn. Inform. (Leningrad), no. 2, 1964 p 20–27, 47–48

(FTD-TT-65-1304/1+2+4; TT-66-61410; AD-633683) CFSTI: HC $2.00/MF $0.50

Contents: Certain Problems of Translation from Information-Logical Language into Russian, by Ye. V. Paducheva; and Device for the Selection of Information by the Given Word, by D. G. Antidze. TAB

N66-34170# California Univ., Los Angeles. Western Management Science Inst.
UTILIZATION OF MEMORY IN CONCEPT LEARNING SYSTEMS Working Paper No. 99
Earl Hunt Apr. 1966 51 p refs Presented at 2d Ann. Carnegie Inst. of Tech. Symp. on Cognition, Pittsburgh, 7–8 Apr. 1966 Submitted for Publication
(Contract Nonr-233(75))
(AD-634483) CFSTI: HC $2.00/MF $0.50

As part of a series in artificial intelligence experiments, four different computer programs for concept learning were tested on five problems of varying complexity. The amount of information which a program could store while solving the problem was varied independently. Program performance could be described as a function of the location of a given study in an abstract space defined by problem complexity and the amount of memory available. The results were discussed in terms of previous work on concept learning and for their implications in the general fields of artificial intelligence and the psychology of human learning. Author (TAB)

N66-34234# Raytheon Co., Alexandria, Va. Autometric Operation.
MODES OF SATELLITE TRIANGULATION ADJUSTMENT. VOLUME II: PROGRAM DOCUMENTATIONS
Michael W. Creusen and Soren W. Henriksen Apr. 1966 87 p ref
(Contract DA-44-009-AMC-1327(X))
(Rept.-163; AD-633864) CFSTI: HC $3.00/MF $0.75

Computer program documentation and subroutines used in triangulation of satellite positioning and error correction are compiled. Subroutines and flow charts, arranged in alphabetical order, include data on: programming language, machine configuration, restrictions, assumptions, options, method, usage, calling sequence, error, accuracy, input format, and output format. R.Li.

N66-34241# Burroughs Corp., Paoli, Pa. Defense, Space and Special Systems Group.
RESEARCH STUDY OF LOGIC DESIGN TRANSLATOR TECHNIQUES Final Report
30 Sep. 1965 234 p ref
(AD-634508) CFSTI: HC $6.00/MF $1.25

During the contract there were three distinct areas of work on the Logic Design Translator (LDT). A section of this report is devoted to each of these areas. Section 2 reports how the programs for the LDT in existence at the initiation of this contract have been maintained. This maintenance is included both small corrections and minor improvements to the programs. Section 3 reports how two fundamental extensions to the LDT programs were developed and other possibilities studied. A library facility has been programmed to operate with a revised version of the LDT. A simulator to operate at the register level from the design tables of the LDT has been specified. The four other possible extensions studied, but not incorporated into the LDT, were diagnostic procedures based upon LDT tables, new ways for the designer to specify the control of microsequences, alternative timing algorithms for the LDT programs, and a way to choose the most economical implementations of a system. Section 4 reports how the LDT programs were translated from the existing version in BALGOL for the 220 into ALGOL '60 for the 1604A and ALGOL for the Burroughs B5500. Section 5 contains the conclusions of this study and recommends areas for extension of the LDT. Author (TAB)

N66-34282# System Development Corp., Santa Monica, Calif.
THE Q-32 LISP 1.5 MOD. 2.6 SYSTEM. OPERATING SYSTEM, INPUT-OUTPUT, FILE, AND LIBRARY FUNCTIONS
S. L. Kameny and C. Weissman 11 Apr. 1966 29 p
(Contract AF 19(628)-5166; ARPA Order 773)
(TM-2337/103/00; AD-633929) CFSTI: HC $2.00/MF $0.50

This document supplements TM-2337/101/00 (AD-622 018) by describing the input-output, file-handling, and library functions of Q-32 LISP 1.5 Mod. 2.6. It also describes differences between Mod. 2.6 and the previous Mod. 2.5 described in TM-2337/102/00 (AD-622 022) dated 9 August 1965. Author (TAB)

N66-34316*# Computer Sciences Corp., El Segundo, Calif.
INFORMATION RETRIEVAL AND ENGINEERING AIDS SYSTEM Final Report
15 Jul. 1966 21 p
(Contract NAS9-3710)
(NASA-CR-65454) CFSTI: HC $1.00/MF $0.50 CSCL 05B

For use in the development and construction of manned spacecraft systems of the Apollo program, an information retrieval and engineering aids system was designed, manufactured, and tested. Engineering data handled includes complete descriptive information of development, test, and flight models, as well as ground support equipment. The computer program system, designed to process, catalog, edit, and report volumes of engineering data generated, consists of four major programs: input processor, master file update, generation breakdown, and report generator. Sorting capability and operation procedures are briefly outlined. R.Li.

N66-34328# Joint Publications Research Service, Washington, D. C.
TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON ELECTRONIC COMPUTER TECHNIQUES
3 Aug. 1966 78 p refs Transl. into ENGLISH from the Publ. "XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio. Sektsiya Elektronno-Vychislitel'noy Tekhniki" Moscow, 1966 p 3–64
(JPRS-36821; TT-66-33251) CFSTI: $3.00

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2. SELECTION OF AN INTERNAL LANGUAGE FOR DIGITAL COMPUTERS I. I. Luk'yanchikov p 7–12 ref (See N66-34330 20-08)
3. ACCELERATED EXECUTION OF LOGICAL OPERATIONS IN ELECTRONIC DIGITAL COMPUTERS L. Ye. Yashchuk p 13–16 (See N66-34331 20-08)
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7. PRACTICAL NETWORKS OF TUNNEL DIODE PULSE UNITS M. I. Andreyev p 36–41 (See N66-34335 20-10)

8. A HYBRID CONVERTER USING TUNNEL DIODES M. I. Andreyev p 42–46 refs (See N66-34336 20-08)

9. RESEARCH ON RADIO PULSE TUNNEL DIODE MULTIFREQUENCY TRIGGER S. S. Garmatyuk p 47–51 refs (See N66-34337 20-10)

10. CALCULATING OPTIMUM PARAMETERS OF RADIO-ELECTRO-TECHNICAL UNITS WITH THE AID OF AN ELECTRONIC DIGITAL COMPUTER D. I. Batishchev p 52–58 (See N66-34338 20-10)

11. PRACTICAL ALGORITHMS OF SEARCHING FOR OPTIMUM REDUNDANCY B. I. Belov, V. A. Ovchinnikov, and L. V. Surkov p 59–66 (See N66-34339 20-08)

N66-34329# Joint Publications Research Service, Washington, D. C.

A METHOD FOR AUTOMATIC ELECTRONIC DIGITAL COMPUTER DESIGNING

G. Grigas *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 1–6 refs (See N66-34328 20-08) CFSTI: $3.00

The design of digital computer languages is considered, and their objects are compared with those of computer programming design. It is noted that the specialization of languages in designing causes difficulties in translation rather than difficulties in describing the various systems in a single language. In practice, the designing procedure is described as including (1) a description of instructions or algorithms for their execution, (2) routines for subprograms, (3) logical routines, and (4) functional systems; and an attempt is made to describe a proposed language. M.W.R.

N66-34330# Joint Publications Research Service, Washington, D. C.

SELECTION OF AN INTERNAL LANGUAGE FOR DIGITAL COMPUTERS

I. I. Luk'yanchikov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 7–12 ref (See N66-34328 20-08) CFSTI: $3.00

The Polish system for notation of algebraic expressions is used as the basis for designing an internal machine language for a digital computer. Use of the syllabic principle of recording program information permits an instruction format of a variable size in a dense or word-to-word recording of the program. Information density is increased by the use of address-free computational results; and the variable and flexible format of the instruction word is considered to have great possibilities for the organization of address conversions. It is shown that formal verification of the feasibility of such a program can be made because of certain specific regular patterns that exist in reverse Polish notations. (In reverse notation, an operation is executed every time an ordered symbol is deciphered, since the operands being used are already in internal storage; in the direct notation, starting time of operation is determined by the entering time of the corresponding operands.) Storage capabilities for the developed program are discussed; and it is noted that there is a special mechanism for sequential deciphering of the program and a single format for operator and address syllables. M.W.R.

N66-34331# Joint Publications Research Service, Washington, D. C.

ACCELERATED EXECUTION OF LOGICAL OPERATIONS IN ELECTRONIC DIGITAL COMPUTERS

L. Ye. Yashchuk *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 13–16 (See N66-34328 20-08) CFSTI: $3.00

The elementary operations which are considered inherent to a proposed method for the execution of logical operations on a digital computer are listed as: (1) clearing registers and accumulator, (2) receiving code 1 from storage in both registers, (3) adding accumulator code with direct or inverse code of the first register, (4) clearing first register, (5) transferring code 2 from storage to both registers, (6) repeating 3, (7) repeating 4, (8) transferring codes from second to first register, (9) repeating 3, and (10) transferring coded results from accumulator to storage. While the execution of operations (3), (6), and (9) depends upon the type of logical operation, the other seven elementary operations are always executed. The method described does not involve an increase in arithmetic unit apparatus and requires only a slight increase in the control unit. M.W.R.

N66-34334# Joint Publications Research Service, Washington, D. C.

CALCULATING SEVERAL PARAMETERS OF THE MEMORY ELEMENT OF AN INDUCTIVE SEMIPERMANENT STORAGE UNIT

A. V. Petrov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 30–35 (See N66-34328 20-08) CFSTI: $3.00

A method is presented which can be used for estimating the effect of the various parameters of memory elements on the primary characteristics of semipermenent inductive storage units. This method, which is considered relatively simple, substitutes the external metal conductors by insulated filaments of current that are closely intercoupled and by storing the location of the current trajectory in the conductor. To accomplish the necessary calculation, the magnetic field must satisfy the boundary conditions on the surfaces of the inserted metallic bodies, the equivalent of the dense body must be isotropic, and the shape of the excitation is specified. A system of linear equations is given, from which the unknown transmission factor can be determined. The density distribution of the eddy currents along the shielded area is found, which permits an estimate of the induced signal-noise on adjacent readout windings. M.W.R.

N66-34338# Joint Publications Research Service, Washington, D. C.

A HYBRID CONVERTER USING TUNNEL DIODES

M. I. Andreyev *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 42–46 refs (See N66-34328 20-08) CFSTI: $3.00

A schematic is shown for a hybrid nine-digit converter which uses tunnel diodes and is constructed by subtraction and comparison with feedback. The control unit forms the sequence of voltage pulses, the decoding unit forms the feedback voltage, and the compare unit compares input and feedback voltages and increases the voltage in the case of a mismatched signal. It is the presence of a mismatched signal which forces the control unit to produce a code with less error. The use of tunnel diodes and inverted diodes in the transistor networks substantially increases the operational speed of the hybrid converter. M.W.R.

N66-34339# Joint Publications Research Service, Washington, D. C.

PRACTICAL ALGORITHMS OF SEARCHING FOR OPTIMUM REDUNDANCY

B. I. Belov, V. A. Ovchinnikov, and L. V. Surkov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 59–66 (See N66-34328 20-08) CFSTI: $3.00

Optimum redundancy is discussed in terms of increasing the reliability of digital computers. The three methods described for solving the problem of obtaining optimum redundancy are: (1) arbitrary extremum, (2) linear programming, and (3) steepest descent. It is noted that a program for solving the optimum redundancy problem was developed for the Minsk-2 computer, and block diagrams illustrate the routines for solutions by methods (1) and (3). Further development of the program may be carried out by compiling subroutines for calculating failure-free redundant sections for the various redundancy methods, as well as compiling ordered search routines for the subroutines. It is stated that the method of steepest descent has the advantage of producing multiples of redundancy in complex form. M.W.R.

N66-34341# Illinois Univ., Urbana.
A NEW METHOD FOR CONSTRUCTING MULTIPLE ERROR CORRECTING LINEAR RESIDUE CODES
John T. Barrows, Jr. Jan. 1966 63 p refs
(Contract DA-28-043-AMC-00073(E); Grant NSF GK-690)
(R-277; AD-627974) CFSTI: HC $3.00/MF $0.75

Linear residue codes are useful in a number of applications due to their ease of implementation. For error control in data transmission they do not require special equipment; and encoding and decoding operations can easily be carried out in digital computers. They are also useful for checking arithmetic operations in a computer. An iterative procedure is used to construct linear residue codes for the correction and detection of multiple random errors. This procedure and number theoretic concepts are used to develop a theory for a class of multiple error correcting codes which have the property that the number of code words is a prime number. Applications to the practical coding problem are also discussed and examples given. Author (TAB)

N66-34425*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AMTRAN HARDWARE—AN ELECTRONIC INTERFACE TO SIMPLIFY AND SPEED UP MAN MACHINE COMMUNICATION
Juris Reinfelds, R. N. Seitz, L. H. Wood, and C. A. Ely May 1966 99 p refs
(NASA-TM-X-53343) CFSTI: HC $2.50/MF $0.75 CSCL 09B

This report contains a complete description of the AMTRAN II on-line remote terminal for the IBM 1620 computer. It provides easy and rapid communication with the computer through a large keyboard, immediate display of intermediate and final results on a cathode ray oscilloscope and hard copy on a special typewriter. Author

N66-34433*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER PROGRAMS FOR SPHERICAL SATELLITES
Joseph T. Skladany *In* NASA. Washington Heat Transfer Computer Programs [1964] 14 p ref (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

This paper describes briefly two rather specialized computer programs which solve for steady-state temperatures over a sphere. The first program deals with opaque surfaces and allows for skin conduction and black body internal radiation. This program differs from the conventional 3-D heat transfer programs in that it automatically subdivides the sphere into a specified number of nodes and computes for each node, surface area, conductances, radiation shape factors and incident solar flux. The second program allows for transmission through partially or fully transparent external surfaces and accounts for multiple diffuse reflections at the inner surfaces, but does not include conduction. Author

N66-34468# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GRAPHICS Semiannual Techincal Summary Report, 1 Dec. 1965–31 May 1966
Jack I. Raffel 31 May 1966 13 p
(Contract AF 19(628)-5167; ARPA Order 691)
(ESD-TR-66-212; AD-634251) CFSTI: HC $1.00/MF $0.50

Efforts in the Graphics Program have continued to concentrate on the development of the graphical service system and VITAL, a compiler-compiler. The latter program is now operational. Development of a debugging system which utilizes graphics as a central communications medium has been initiated. In an effort to improve the methods of generating points, lines, and general conic sections in display systems, a simple waveform generator has been designed, based on homogeneous coordinate mathematics. The hardware problems in the implementation of this design are being investigated. A three-dimensional-ultra-sonic position-sensing device has been installed in TX-2 and initial evaluation is under way.
Author (TAB)

N66-34520# Stanford Research Inst., Menlo Park, Calif.
TRAINING A LINEAR MACHINE ON MISLABELED PATTERNS
R. O. Duda Apr. 1966 115 p refs
(Contract Nonr-3438(00))
(AD-634484) CFSTI: HC $4.00/MF $0.75

A linear machine is a multicategory classifier that can be trained to classify a pattern from a set of linearly separable patterns into one of a finite number of categories. This report is concerned with the behavior of a linear machine when the training patterns are not linearly separable. Particular attention is devoted to the nonseparable problem arising when the training patterns are randomly mislabeled. Training is viewed as a Markov process, and the behavior of the time-average linear machine is analyzed. It is shown that the time-average linear machine converges to a limiting classifier with probability one, and that this limiting classifier is optimal if the pattern vectors are orthogonal. When the pattern vectors are not orthogonal, the performance may not be optimum; however, experimental results show that averaging usually improves performance of a linear machine quite significantly over that obtained by error-correction alone. Author (TAB)

N66-34540# Office of Naval Research, Washington, D. C.
INFORMATION SYSTEMS SUMMARIES
Richard H. Wilcox Jul. 1965 76 p refs
(ONR-ACR-113; AD-634526) CFSTI: HC $3.00/MF $0.75

Contents: general information sciences, machine interaction with humans, improved machines. TAB

N66-34705*# Planning Research Corp., Los Angeles, Calif.
A SURVEY OF SPACEBORNE COMPUTERS Technical Advisement Memorandum No. 171-1
George Liviakis 27 Jun. 1966 28 p
(Contract NAS8-20367)
(NASA-CR-77359; PRC-D-1237) CFSTI: HC $2.00/MF $0.50 CSCL 09B

Results are presented of a preliminary survey of a set of computers generally applicable to the Airborne Evaluation

Equipment (AEE) problem. Although no conclusions were drawn from the data obtained, it is stated that these data may be useful in the conceptual design of alternate AEE hardware systems. The parameters used in characterizing the computers included main memory characteristics, scratch pad memory characteristics, arithmetic characteristics, addressing structure, input/output organization, interrupt system, physical characteristics, operating and environmental characteristics, availability of acceptable peripheral devices, compatibility with ground based computers, maturity and availability of hardware, and performance measure. Data sheets for the computers evaluated, and a summary chart of all major characteristics are included. H.S.W.

N66-34706# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

USE OF BULK CORE MEMORY IN IMPROVING TIME SHARING EFFICIENCY

E. D. Reilly, Jr. [1965] 7 p Presented at the Spec. Tech. Meeting on Use of Remote Access, Time Sharing Computer Systems, Schenectady, N. Y.

(Contract W-31-109-ENG-52)

(CONF-650621-1) CFSTI: HC $1.00/MF $0.50

The problem of deterioration of the computer efficiency in the "swapping" of jobs between the main memory and the auxiliary storage device in computer time sharing is considered. Efficiency comparisons are made for drum and bulk core memory devices and three computer classes (GE 625, CDC 6600, and CDC 6800). It is shown that the use of a bulk core memory results in high efficiency and a small time quantum. NSA

N66-34751# Oak Ridge National Lab., Tenn.

A COMPUTER PROGRAM FOR PREDICTING COATED-PARTICLE BEHAVIOR

J. W. Prados Mar. 1966 32 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-1385) CFSTI: HC $2.00/MF $0.50

A computer program is developed for use in calculating conditions under which the pyrolytic-carbon coatings of fuel microspheres would be expected to fail. Working equations and a listing of the Fortran-63 source program are presented, together with instructions for furnishing input data.

Author (NSA)

N66-34759# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

TEMCO—A FORTRAN PROGRAM FOR COMPUTING TEMPERATURE COEFFICIENTS

F. W. Todt 28 Dec. 1965 94 p refs

(Contract AT(04-3)-167)

(GA-6734) CFSTI: HC $3.00/MF $0.75

TEMCO is a semiautomated procedure for obtaining temperature coefficients. Given cross-section libraries for each temperature to be considered, the code performs a series of one-dimensional diffusion calculations and then uses the results to generate the temperature coefficient. In addition to the temperature coefficient, the factors η, ϵ, p, f, and the temperature derivatives of these quantities are calculated. The code also computes the contribution of each individual nuclide to the temperature derivatives. The program was written in FORTRAN IV for the IBM 7044. NSA

N66-34781*# Arinc Research Corp., Washington, D. C.

DESCRIPTION OF THE COMPUTERIZED RELIABILITY ANALYSIS METHOD (CRAM) Arinc Research Monograph No. 11

David E. Van Tijn 13 Nov. 1964 104 p refs

(Contract NAS8-11087)

(NASA-CR-77414; Publ.-294-02-14-444) CFSTI: HC $4.00/MF $0.75 CSCL 09B

Applications, procedures, and analyses are made for the Computerized Reliability Analysis Method (CRAM), which is a method for analyzing reliability by using computer programs that are strictly utility routines. In concept, CRAM can be used for all systems in which a failure of one part can be defined without reference to any other part. On the basis of a system description, operating modes are identified and the system is partitioned into subsystems. Reliability diagrams are prepared for these individual subsystems, and data on subsystem elements and failure probabilities of the element classes are tabulated. The first computer program converts the coded reliability diagrams into a formula representing the condition for system success; a second program converts this formula into a reliability model; and a third program computes a reliability value for the subsystem from the model and data tables. The subsystem values are then converted into a single value representing the system. Preparation of computer inputs is detailed, computation of reliability expressions and functions is discussed, and a list of applicable definitions is included. M.W.R.

N66-34847*# National Aeronautics and Space Administration, Washington, D. C.

DIGITAL COMPUTERS FOR COMPILING MILLING MACHINE PROGRAMS

Y. A. Brik *In its* Autom. Regulation and Control Jul. 1966 p 261–282 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Details are given on a prototype digital computer intended for compilation of the program for machining on a milling machine, with automatic control of parts whose profiles consist of rectilinear segments and arcs of circles. The basis of the computer is a new mathematical algorithm by which the coordinates of the sequential points of the circle and straight line are calculated by the reported equations; its salient feature is the generation of the machining program in the form of binary coded numbers. This method permits a reduction of the volume of information introduced into the machine tool (in comparison with the unitary code); also, a relatively simple computer is installed directly at the machine (linear interpolator), which can operate with high reliability. Illustrated are: block diagrams of the operation model, and of the arithmetic unit; blocking circuit, roundoff blocks; and, stop, input, and control units. R.U.

N66-34877# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A COMPUTER TECHNIQUE USEFUL FOR SOME PROBLEMS IN THE PARTITIONING THEORY OF SEQUENTIAL MACHINES

William J. Sacco Mar. 1966 18 p refs

(BRL-MR-1733; AD-634920) CFSTI: HC $1.00/MF $0.50

One of the most powerful theories to emerge in sequential machine theory in the last few years is partitioning theory, as developed principally by J. Hartmanis and R. Stearns. There exist several valuable concepts used in partitioning theory, such as the partition with substitution property, partition pairs, and systems-pairs. Partitioning theory enables one to consider the possibility of realizing a given sequential machine M from interconnected sets of smaller machines. Partitions with substitution property, partition pairs, and systems-pairs play a dominant role in the study of machine decomposition. Methods for generating partitions with substitution property have been

given by Hartmanis and F. Farr. This paper presents a computer technique which enables one to verify whether, (1) a partition possesses substitution property, (2) two partitions constitute a partition pair, and (3) two set systems constitute a systems-pair. Author (TAB)

N66-34897# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERAL RESEARCH Quarterly Technical Summary Report, 1 Feb.-30 Apr. 1966
Frederick C. Frick et al 15 May 1966 53 p refs
(Contract AF 19(628)-5167)
(ESD-TR-66-205; AD-634819) CFSTI: HC $3.00/MF $0.75

Summaries are given of progress and results in the following research areas: digital computers (computer systems, circuit development, magnetic film engineering, system programming and applications); computer components (magnetic films, optics, electron transport, advanced circuits); psychology (on-line computing services for scientists and engineers, human information processing, quantitative methods); computer systems (computation center development, hybrid computational facility); surveillance techniques (operation, maintenance, and improvements, space surveillance, lunar studies, planetary studies, atmospheric studies, radio astronomy, space communication); microwave components (introduction, haystack microwave components, solid-state amplifiers, vhf modification to tradex error horns); mechanical engineering (haystack, millstone, solid state research, laser radar, structures research); solid state-device research, optical techniques and devices, materials research, physics of solids. TAB

N66-34977# International Business Machines Corp., Yorktown Heights, N. Y.
SPECIFICATION AND UTILIZATION OF A TRANSFORMATIONAL GRAMMAR Scientific Report No. 1
David V. Lieberman Mar. 1966 305 p refs
(Contract AF 19(628)-5127)
(AFCRL-66-270; AD-635520) CFSTI: HC $7.00/MF $1.50

The report contains four parts: Part I—the IBM core grammar of English, our current grammar of English is presented in full, and numerous derivations are carried out in detail to illustrate the current generative power of the grammar. Part II—design of a grammar tester, the design considerations on which the present version of the tester was based are discussed, and a set of tentative input, output, and control formats are presented. Part III—programming for the grammar tester, a list implementation of the grammar tester is presented. The overall flow of control and the various special functions are described. Part IV—computer support for lexicon development. A program package (programmed in SNOBOL) to facilitate the compilation, modification, scanning, etc. of the lexicon is described. Author (TAB)

N66-35039# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
SAN 64: A PROGRAM FOR SPATIAL RECONSTRUCTION OF EVENTS IN A TWO-VIEW DIFFUSION CHAMBER. PART II: FIGURES [SAN 64: UN PROGRAMMA PER LA RICOSTRUZIONE SPAZIALE DI EVENTI IN CAMERA A DIFFUSIONE CON DUE VISTE. PARTE II: FIGURE]
P. Salvadori 14 Mar. 1966 96 p In ITALIAN; ENGLISH summary
(ISS-66/12) CFSTI: HC $3.00/MF $0.75

SAN 64 is a program for the IBM 7040 computer useful in analyzing events occurring in a two-view diffusion chamber. The first part describes the program explaining the formulae and giving instructions for it. The second part contains the figures related to the description of the program. The third part presents the block-diagrams with which the program instructions can be followed step by step. In the fourth part the complete listing of the Main Program with its 11 Subroutines is printed. Author

N66-35040# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
SAN 64: A PROGRAM FOR SPATIAL RECONSTRUCTION OF EVENTS IN A TWO-VIEW DIFFUSION CHAMBER. PART IV: LIST OF INSTRUCTIONS [SAN 64: ON PROGRAMMA PER LA RICOSTRUZIONE SPAZIALE DI EVENTI IN CAMERA A DIFFUSIONE CON DUE VISTE. PARTE IV: LISTA DELLA ISTRUZIONI]
P. Salvadori 14 Mar. 1966 47 p In ITALIAN; ENGLISH summary
(ISS-66/14) CFSTI: HC $2.00/MF $0.50

SAN 64 is a program for the IBM 7040 computer useful in analyzing events occurring in a two-view diffusion chamber. The first part describes the program explaining the formulae and giving instructions for it. The second part contains the figures related to the description of the program. The third part presents the block-diagrams with which the program instructions can be followed step by step. In the fourth part the complete listing of the Main Program with its 11 Subroutines is printed. Author

N66-35041# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
SAN 64: A PROGRAM FOR SPATIAL RECONSTRUCTION OF EVENTS IN A TWO-VIEW DIFFUSION CHAMBER. PART I: GENERAL DESCRIPTION [SAN 64: UN PROGRAMMA PER LA RICOSTRUZIONE SPAZIALE DI EVENTI IN CAMERA A DIFFUSIONE CON DUE VISTE. PARTE I: DESCRIZIONE GENERALE]
P. Salvadori 14 Mar. 1966 66 p refs In ITALIAN; ENGLISH summary
(ISS-66/11) CFSTI: HC $3.00/MF $0.75

SAN 64 is a program for the IBM 7040 computer useful in analyzing events occurring in a two-view diffusion chamber. The first part describes the program explaining the formulae and giving instructions for it. The second part contains the figures related to the description of the program. The third part presents the block-diagrams with which the program instructions can be followed step by step. In the fourth part the complete listing of the Main Program with its 11 Subroutines is printed. Author

N66-35055# Frankford Arsenal, Philadelphia, Pa. Propellant Actuated Devices Div.
DIGITAL COMPUTER SIMULATION OF BALLISTICALLY OPERATED HIGH-LOW SYSTEMS
Leonard A. De Stefano May 1966 27 p
(FA-M66-22-1; SEG-TR-66-14; AD-634978) CFSTI: HC $1.00/MF $0.50

The report presents a digital computer simulation of the performance of high-low propellant actuated devices. The equations describing these devices are presented and solved simultaneously by 4th order Runge Kutta methods programmed in Fortran for the Univac Solid State 90 digital computer. The computer program, its input-output formats, and a comparison between experimental and computed performance are also presented. The results of this comparison indicate that this program adequately simulates the performance of ballistically operated high-low devices and, therefore, may be used as an efficient tool to aid in their design and in the estimation of their performance. Author (TAB)

N66-35085# Istituto Superiore di Sanita, Rome (Italy).
SAN 64: A PROGRAM FOR SPATIAL RECONSTRUCTION OF EVENTS IN A TWO-VIEW DIFFUSION CHAMBER, PART III [SAN 64: UN PROGRAMMA PER LA RICOSTRUZIONE SPAZIALE DI EVENTI IN CAMERA A DIFFUSIONE CON DUE VISTE]
P. Salvadori 14 Mar. 1966 143 p *In* ITALIAN
(ISS-66/13) CFSTI: HC $4.00/MF $1.00

SAN 64 is a program for the IBM 7040 computer useful in analyzing events occurring in a two-view diffusion chamber. Formulae and instructions for the program are presented. Figures related to the description of the program are included. Block-diagrams with which the program instructions can be followed step by step are presented. The complete listing of the main program with its 11 subroutines is printed. Author

N66-35097# General Electric Co., Syracuse, N. Y. Electronics Lab.
DIGITAL CONTACT ANALOG Final Report, Jan. 1963-May 1966
Edmund C. Wild Jun. 1966 32 p ref
(Contract Nonr-4057(00))
(AD-635031) CFSTI: HC $2.00/MF $0.50

The objective of this work was to develop, design and provide an advanced laboratory version of a digitally implemented contact analog display system with the capacity to generate the following surfaces and symbols: (a) a ground plane whose textured surface included a runway and a unique area that had a texture pattern distinct from that of the general ground texture. The ground plane was to consist of four nested patterns that were useful over an extended altitude range, (b) a sky plane whose texture pattern was distinct from that of the ground plane and that would include a unique pattern to indicate the zenith, (c) terrain information encoded in the form of two rectangular parallelopipeds or obstacles that could be located at selected points on the ground plane, (d) three symbols located in the plane of the display; these symbols being: an airborne target symbol, a weapons symbol, and an impact point symbol, (e) two sets of four digit numbers located in the display plane, and (f) an earth-stabilized flight path that would respond to 360° rotation about all axes and that could be used as flight director, if so desired. The report describes the display content and the flexibility of the system. A brief discussion of the computer techniques employed to generate the display and a functional description of the system are included. TAB

N66-35137# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugmechanik.
REPORT ON THE COMPUTATION CENTER OF THE DEUTSCHE FORSCHUNGSANSTALT FUER LUFT- UND RAUMFAHRT FOR THE YEAR 1965 [BERICHT UEBER DAS RECHENZENTRUM DER DEUTSCHEN FORSCHUNGSANSTALT FUER LUFT- UND RAUMFAHRT FUER DAS JAHR 1965]
R. Ludwin Mar. 1966 50 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-66-02) CFSTI: HC $2.00/MF $0.50

Following up the report presented for 1964 another report is given covering the period of 1965. The number of computing schemes has increased by approximately 50%. The Digital Computer Siemens 2002 has been completed by a punch card system and a high-speed printer, and preparations have been made for operation by magnetic tapes. Compared to 1964, the extent of operations carried out by the Analog computer has considerably increased, and the equipment of the Analog computer PACE 231 R was likewise completed. Author

N66-35174*# General Dynamics/Convair, San Diego, Calif.
A METHOD FOR EVALUATION OF STABILITY MATRIX ELEMENTS
14 Jul. 1965 51 p ref
(Contract NASB-11479)
(NASA-CR-77430; GD/C-DDF-65-004) CrSTI: HC $3.00/MF $0.50 CSCL 09B

The results of a study which leads to the formulation of a digital computer program system are presented. The study consisted of evaluating the various methods of obtaining and compiling that basic data required for stability analysis. The computer program system formulated provides a means of evaluating the elements of a 25X25 second order matrix for use in stability analysis. Logic and data flow charts for the Optimum Dynamic Data Flow System are presented. These flow charts are detailed to the extent that a working program system could be generated. Input formats and data sources are indicated by the input formats and discussion. Author

N66-35206*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A DIGITAL HIGHER ORDER INTERPOLATION PATH CONTROLLER
William Granville Batte Washington, NASA, Sep. 1966 89 p refs
(NASA-TN-D-3577) CFSTI: HC $2.50/MF $0.75 CSCL 09B

A two axis digital higher order interpolation path controller for generating a smooth incremental path through discrete Cartesian input data was designed, constructed, and evaluated. The interpolation technique has a simple digital implementation relative to classical higher order interpolation schemes. It is readily adaptable to incremental methods and to the calculus of finite differences. In addition, it accommodates unequal argument spacing, processes multivalued and closed contour functions, can accommodate raw or non-preprocessed data, and is readily expandable to multidimensions. The experimental model was evaluated with a standard incremental x-y plotter as the output device and a punched paper tape reader as the input device. Laboratory tests were made on the implemented system and actual copies of its output are included. Results show that the approach is feasible and that the research objectives are met. R.N.A.

N66-35237*# California Univ., Berkeley. Space Sciences Lab.
AN APPROACH TO THE DESIGN OF A UNIVERSITY COMPUTER CENTER IN THE BEGINNING OF THE 1970's
Jean Yvon Birrien Jun. 1966 92 p refs *Its* Internal Working Paper No. 47
(Grant NsG-243-62)
(NASA-CR-77507) CFSTI: HC $3.00/MF $0.75 CSCL 09B

The problems involved and a methodology for the formulation of a theory of data processing systems are discussed, with particular attention to a system for a university computer center. The present tasks of a center and the projected needs of the 1970's are analyzed. The evolution of the system and of the scientist in the computer field are described, and the time sharing system is emphasized. Recommendations are given, and and an example of a time sharing center and its cost analysis are included. N.E.N.

N66-35286# Atomic Weapons Research Establishment, Aldermaston (England).
DICE No. V—THE PREPARATION OF NUCLEAR DATA INTO A FORM SUITABLE FOR MONTE CARLO CALCULATIONS USING AN ELECTRONIC COMPUTER
J. B. Parker, ed. May 1966 115 p refs
(AWRE-O-27/66) HMSO: 14s

A description is given of the way in which the contents of the UKAEA Nuclear Data Library are converted for use in IBM 7030 calculations employing the Monte Carlo method. The basic idea is that the data for all nuclides likely to be used in a Monte Carlo problem are written, after having been processed in a special way, on a master (MOULD) tape. This tape is an input tape for every Monte Carlo run. A subroutine of the main program, called ABSYNTH, then reads the required nuclide information germane to the problem in hand from a MOULD tape and locates it in the fast-access store of the computer. This is done at the start of each Monte Carlo run, which automatically enters the neutron tracking phase when the ABSYNTH routine is completed. C.T.C.

N66-35297# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

AN ANALOGUE COMPUTER FOR PARTICLE SIZE ANALYSIS

H. A. Cole Feb. 1966 36 p refs

(AERE-R-5096) CFSTI: HC $2.00/MF $0.50

An analog computer is described which operates in conjunction with the Karl Zeiss particle size analyzer. The analyzer is used to measure the diameter distribution of bubbles in a photograph of a column of foam, and the computer makes use of this information to provide simultaneous and separate indications proportional to total surface area and volume as the analysis proceeds. These indications enable an immediate determination of the mean surface area of foam per unit volume of contained air for the sample. The computer may also be used with the analyzer for the total area analysis of particles of approximately circular shape, or for total area and volume analysis of particles of approximately spherical shape. Author

N66-35304# United Kingdom Atomic Energy Authority, Culham (England). Research Group.

THE INPUT LANGUAGE FOR THE EGDON COMPUTING SYSTEM

K. V. Roberts Mar. 1966 23 p refs Submitted for Publication

(CLM-P-100) CFSTI: HC $1.00/MF $0.50

The computing installation in a scientific laboratory ought to be a powerful intellectual tool, able to undertake any routine logical task rapidly and without error, and so free the scientist or mathematician for more creative work that a machine cannot do. It is a paradox of many existing computing systems that they often produce exactly the opposite effect: the user is presented with numerous routine tasks that he has to do for the machine, such as writing and checking programs and manipulating decks of cards, and he has less time for creative work than before. To correct this situation and so maximise the effectiveness of the computing system for the scientist, it is necessary to examine very carefully all the interfaces between man and machine, and one of the most critical of these is the 'input language' in which his problems or commands are communicated. The use of a magnetic disc file enables a very general and convenient type of language to be introduced, in which information is manipulated symbolically and problems are communicated to the system in concise mathematical form. Author

N66-35305# United Kingdom Atomic Energy Authority, Harwell (England). Solid State Physics Div.

AN ATLAS COMPUTER PROGRAMME TO PRODUCE DIFFRACTOMETER CONTROL TAPES

N. A. Curry May 1966 16 p ref

(AERE-R-5213) CFSTI: 1s 9d

A description is given of a computer programme written for ATLAS, which generates 5-hole punched paper tape to control Ferranti Mark II automatic diffractometers. Details of the format required for the input and the format of the tape which is produced are provided. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-34120# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

NANOSECOND SWITCHING OF AN ELECTRON BEAM

Raymond V. Sutton (M.S. Thesis) Mar. 1966 59 p refs

(GSP/PH/66-18; AD-634505) CFSTI: HC $3.00/MF $0.75

A triple grid electron beam switch was designed to provide long current pulses with fast risetimes and minimum energy dispersion of the current. Theory was developed for a general, idealized switch in which the center conductor of a transmission line became the center grid of the triple grid switch. Thus the voltage on this grid, and the field that switched the electrons, could be that of a nanosecond pulse generator, with no distortion caused by lumped (discrete) electrodes. The theory indicated that transit time effects still limit the operation of the switch, making the requirements for fast risetimes and low energy dispersions incompatible, but that present equipment was capable of nanosecond risetimes with 10% energy dispersions. A switch was built to the theoretical design, and tested on 20–50 volt, 10^{-8} to 10^{-5} ampere electron beams. The output current risetime was at most 6 ns, the risetime of the detector used. Theory also indicated a second mode of operation which might be useful. In this mode the electron beam is used at a distance from the switch, so that the energy dispersion of the beam has time to improve the risetime of the current. There was some indication in the evaluation that this effect occurs. Author (TAB)

N66-34125# General Electric Co., Auburn, N. Y. Semiconductor Products Dept.

RESEARCH AND DEVELOPMENT OF SILICON CONTROLLED RECTIFIERS FOR HIGH FREQUENCY AMPLIFIER APPLICATIONS Final Report, 16 Oct. 1964–16 Jun. 1966

[1966] 100 p

(Contract NObsr-91299)

(AD-634393) CFSTI: HC $3.00/MF $0.75

This final report describes the research and development conducted to obtain a high-current, high-frequency silicon controlled rectifier. The development process including design, optimization, fabrication and characterization is described and discussed in detail. Author (TAB)

N66-34185# Tung-Sol Electric, Inc., Livingston, N. J. Power Tube Div.

PRODUCTION ENGINEERING MEASURE FOR TYPE 7890 SUPER POWER HYDROGEN THYRATRON Final Report, 7 Mar. 1962–15 Apr. 1965

C. L. Shackelford 15 Apr. 1965 325 p refs

(Contract DA-36-039-SC-86954)

(AD-634151) CFSTI: HC $7.00/MF $1.50

The tube design, tooling, and assembly methods followed produce a tube meeting the requirements that the cathode

heater current be limited to 30 amperes, maximum. The principal mechanical problem encountered was the cracking of the metal in anode cups made according to the original design. The means used to by-pass the problem are not an ultimate solution. Grid emission tends to become the limiting factor in the operation of the tube. The emission was suppressed principally by providing means of cooling the grid. The reservoir and the cathode are adequate for present requirements. The tube would be improved by increasing the capacities of both reservoir and cathode. At rated operating conditions, the present limit on the tube's life is in cathode performance. The area of the emitter could be increased conveniently by 15 percent and still be effectively heated within the cathode heater current limitations. Heating time would be relatively unaffected. The reservoir capacity could be doubled at no increase in heating power but only an increase in heating time.
Author

N66-34206*# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
THIN FILM PIEZOELECTRIC RESONATING DEVICE Final Report, 28 May 1965–28 Jul. 1966
T. R. Sliker and D. A. Roberts 28 Jul. 1966 88 p refs
(Contract NAS9-4373)
(NASA-CR-65458) CFSTI: HC $2.50/MF $0.75 CSCL 09A

A new type of miniature resonator for the 100–1000 MHz range has been developed which consists of a piezoelectric CdS transducer evaporated onto a single crystal quartz wafer. Energy trapping principles have been applied to localize the acoustic energy in the quartz wafer to the volume under and immediately surrounding the electrically driven CdS film. Resistances at resonance of 50 ohms and electrical Q's of 5000 typically have been realized with 279 MHz devices. Both shear and longitudinal mode resonators have been fabricated, but shear mode operation has the important advantage that devices with a zero frequency–temperature coefficient are possible.
Author

N66-34223# Philco Corp., Lansdale, Pa.
R AND D PROGRAM TO DESIGN AND FABRICATE DIGITAL MONOLITHIC MICROCIRCUITS HAVING AVERAGE PROPAGATION DELAY TIME OF 1 NS Sixth Quarterly Progress Report, 1 Oct.–31 Dec. 1965
[1966] 15 p Prepared for Lincoln Lab., MIT
(Contracts AF 19(628)-5167; AF 19(628)-500)
(X-507; ESD-TR-66-209; AD-634536) CFSTI: HC $1.00/MF $0.50

Investigations were conducted toward the primary objective of fabricating silicon monolithic microcircuits with average propagation delay times in the subnanosecond region. Preliminary investigations were also made of the speed improvements obtainable by fabricating and interconnecting arrays of high performance microcircuits within a single silicon chip. High speed gates and high speed, high density arrays were the two areas stressed in the development of microcircuits centered about the high performance transistor. Improved transistors, microcircuits and a ring oscillator were fabricated and samples delivered for evaluation.
Author (TAB)

N66-34298# Midland-Wright, Kansas City, Kans.
PRODUCTION ENGINEERING MEASURE RELIABLE QUARTZ CRYSTAL MICROELEMENTS, TYPES EL-MCR01 (X-1) AND EL-MCR02 (X-1) Quarterly Progress Report, 1 Oct.–31 Dec. 1965
Stuart Radetsky [1965] 25 p
(Contract DA-36-039-AMC-03639E)
(QPR-4; AD-634214) CFSTI: HC $1.00/MF $0.50

Plate design improvement has been made for the MRCO1–7.000 MC and MCRO2–20.000 MC units. MCRO1–20.000 MC, MCRO2 - 45.000 MC and MCRO2 - 70.000 MC units passed all of the requirements measured in the first group of engineering samples. Development of a new material and a new application method for crystal tabbing has been initiated. A modified PERT plan for program progress evaluation has been submitted and approved.
Author (TAB)

N66-34310*# Computing Devices of Canada, Ltd., Ottawa (Ontario).
HIGH-SHOCK FM TRANSMITTER Final Report, Phase I
G. E. Brown, J. E. Dawson, and J. R. Beck 22 Oct. 1965 154 p refs /ts Rept.-7060/FR1
(Contract NAS1-5042)
(NASA-CR-66159) CFSTI: HC $3.25/MF $1.00 CSCL 09F

This report describes the work performed under Phase I of Contract NAS1-5042 for the Design, Development, Fabrication, and Testing of High Shock FM Transmitters. Phase I of the Contract was concerned with the qualification of electronic components for use in the transmitters and the development of a transmitter meeting the electrical and physical requirements of the specification. Included in the report are the results of the electronic component test program, the evaluation of the electrical and physical properties of candidate epoxy encapsulants, and a description, schematic diagram, and electrical test results for the transmitter developed under this phase of the contract.
Author

N66-34479# Army Electronics Labs., Fort Monmouth, N. J.
CHROMIUM MASKS FOR MICROCIRCUITRY
Alex Rogel May 1966 20 p refs
(ECOM-2715; AD-634762) CFSTI: HC $1.00/MF $0.50

A method for preparing durable chromium films which may be used as masks in making photoresist patterns for microcircuitry has been developed. Films deposited by this method were found to have excellent adhesion to glass and silicon and produced good uniform and reproducible patterns. A technique for etching chromium films was developed using a photoresist process and an acid and metal etchant.
Author (TAB)

N66-34544# Army Electronics Labs., Fort Monmouth, N. J.
QUARTZ CRYSTAL UNITS FOR VERY HIGH FREQUENCIES
Eduard A. Gerber Apr. 1966 21 p refs
(ECOM-2697; AD-634447) CFSTI: HC $1.00/MF $0.50

A method is briefly described for lapping and polishing round quartz crystals in the frequency range 20 to 180 Mc. The performance of crystals, made by this method, surpasses that of any other known crystals in this range. The average series resistance is 14 ohms at 75 Mc for the third, 40 ohms at 125 Mc for the fifth, and 55 ohms at 175 Mc for the seventh harmonic mode. Methods are described, the application of which will reduce unwanted modes and diminish the influence of the vibrational amplitude upon crystal parameters.
Author (TAB)

N66-34558# Piezo Technology, Inc., Orlando, Fla.
PEM FOR FILTER, QUARTZ CRYSTAL 112 Mc, TYPE EL-FR(X-2) AND CRYSTAL UNIT, FILTER, QUARTZ TYPES CR(XM-64)/U AND CR(XM-65)/U Quarterly Progress Report, 1 Aug. 1965–30 Apr. 1966
W. H. Horton [1966] 41 p refs
(Contract DA-36-039-AMC-03638(E))
(QPR-4; AD-635123) CFSTI: HC $4.00/MF $0.50

The report reviews the contractual and specification modification which became effective during the report period and

describes progress on the fabrication of engineering samples of crystal CR(XM-65)/U and filter EL-FR(X-2). Author (TAB)

N66-34574# Library of Congress, Washington, D. C. Aerospace Technology Div.
LEAD METANIOBATE PIEZOELECTRIC VIBRATION PICKUP
In its Foreign Sci. Bull. Vol. 2, No. 8 Aug. 1966 p 33–35 ref (See N66-34566 20-34)

Reported is the development of an experimental sonic transducer for high temperature applications that utilizes lead metaniobate for its ceramic components and possesses an extended range to 570°C. Preparation of the lead metaniobate material, determination of its electrochemical characteristics, the experimental sonic transducer with built-in lead metaniobate ceramic disks, and the working parameters of this transducer are described in detail. G.G.

N66-34603# Army Electronics Labs., Fort Monmouth, N. J.
PERFORMANCE OF P-N JUNCTION GALLIUM ARSENIDE AVALANCHE (TRANSIT TIME) OSCILLATORS
Vincent J. Higgins, Frank A. Brand, and Joseph J. Baranowski Apr. 1966 25 p refs
(ECOM-2696; AD-635084) CFSTI: HC $1.50/MF $0.50

The report presents preliminary results on the generation of microwave energy from epitaxial gallium arsenide varactor diodes biased into avalanche. These diodes were originally designed to be used in a low-noise parametric amplifier or high-efficiency harmonic generators. An experimental measurement technique using a signal substitution method is fully described. The measurement technique allows one to fully isolate and examine characteristics of the frequency of oscillation without use of filters and to examine any frequency of oscillation between 6.0 and 50 GHz. Details of experimental results on both CW and pulsed oscillators are given. Pulsed oscillations were observed between 7.89 and 31.2 GHz with specific data tabulated. A CW oscillation output of over 20 mW in K_u band, 13.4 GHz with efficiencies of 4–5% was observed. Specific data such as CW output variation with bias current, efficiency variation with bias current, etc., are presented. In addition, parametrically related oscillation and diode tunability are discussed. Author (TAB)

N66-34622# Harry Diamond Labs., Washington, D. C.
ELECTROSTATICALLY FOCUSED BACKWARD-WAVE OSCILLATOR DEVELOPMENT
Burton J. Udelson Apr. 1966 66 p refs
(HDL-TR-1318; AD-635507) CFSTI: HC $3.00/MF $0.75

A program was undertaken at HDL with the objective of developing a backward-wave oscillator (BWO) that would have the properties required for fuzing application (e.g., compact size, light weight, rugged structure, etc.). The BWO was designed to operate at C-band, and utilized two parallel ladder lines that acted both as an rf slow-wave structure and also as an electrostatic-focusing structure for an electron sheet beam. With the knowledge of the basic ruggedness of the ladder-line structure, and of the feasibility of constructing small, lightweight tubes, the BWO program was aimed primarily at achieving satisfactory electrical performance. RF power outputs of the order of 50 mW were obtained, even though misalignments of the ladder-line structure reduced the beam transmission to the collector. Much higher power outputs are visualized for tubes of this design in which satisfactory alignment is achieved. The BWO development program was terminated because of a shift of emphasis in the requirements of HDL systems. The details of fabrication are given for both mechanical designs that were employed during the course of the program, one utilizing a Kovar-glass envelope, and the other consisting of ceramic–metal construction throughout. Some suggestions are also offered as to the direction of future developmental work. Author (TAB)

N66-34648# Joint Publications Research Service, Washington, D. C.
FEASIBILITY OF USING THYRISTORS IN LOW VOLTAGE PULSE CIRCUIT
V. I. Vaganov, V. A. Kuz'min, V. S. Pershenkov, and I. I. Shagurin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Microelectron. 11 Aug. 1966 p 5–10 (See N66-34646 20-10) CFSTI: $2.00

The properties of semiconductor devices with S-shaped volt–ampere characteristics, and the use of thyristors in low voltage pulse circuits are examined. In studying the possibilities of using thyristors in dinistor, trinistor, and tetristor circuits, the feasibility of building thyristor pulse and amplifier circuits, their direct matching, and their advantages and disadvantages as compared with analogous transistor circuits are considered. It is concluded that the most promising applications of thyristors in microelectronic circuits are as accumulating devices, shapers for high power pulses, and generator circuits. It is also stated that the thyristor–transistor combinations are promising, with the tetristor being the most promising thyristor. A.G.O.

N66-34650# Joint Publications Research Service, Washington, D. C.
TWO-DIMENSIONAL THEORY OF THIN-FILM FIELD EFFECT AND MOST TRANSISTORS, ACCOUNTING FOR TRAPS
Yu. S. Ryabinkin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Microelectron. 11 Aug. 1966 p 15–21 refs (See N66-34646 20-10) CFSTI: $2.00

A general expression is presented for the volt–ampere characteristics of a field effect transistor with insulated shutters (FETIC transistor) which accounts for the two-dimensional structure of the shutter induced space charge with and without traps. The various mathematical derivations are shown, and a generally accepted mathematical model of a FETIC transistor is discussed. A.G.O.

N66-34655# Joint Publications Research Service, Washington, D. C.
TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON WAVEGUIDES
9 Aug. 1966 29 p refs Transl. into ENGLISH from the publ. "XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio—Sektsiya Volnovodnykh Ustroystv" Moscow, 1966 p 3–29
(JPRS-36909; TT-66-33339) CFSTI: $2.00

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6. ELECTROMAGNETIC WAVE PROPAGATION IN A SHIELDED HELICAL LINE WITH A DIELECTRIC CORE ALLOWING FOR THE FINITE CONDUCTANCE OF THE HELIX S. A. Vyshinskiy p 22-27 refs (See N66-34861 20-09)

N66-34656# Joint Publications Research Service, Washington, D. C.

A PLANE WAVEGUIDE JUNCTION PROVIDING FOR A MINIMUM REFLECTION COEFFICIENT

A. I. Tereshchenko and V. V. Dolzhikov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Waveguide 9 Aug. 1966 p 1-6 refs (See N66-34655 20-09) CFSTI: $2.00

Formulas are derived for smooth waveguide junctions providing minimum losses through reflection of the dominant mode for the case where the junction is between two rectangular waveguides with similar cross sections, or with sections whose dimensions are different in the H plane. The geometry of waveguide junctions with different cross sections in the E plane is also determined, and a comparison is made of step and smooth junctions. It is noted that a smooth junction is preferable when large amounts of power are involved and the small dimensions are not required. A.G.O.

N66-34657# Joint Publications Research Service, Washington, D. C.

THE WAVE IMPEDANCE OF AN ASYMMETRICAL STRIP LINE WITH A CONDUCTING PLATE OF ARBITRARY THICKNESS

N. I. Lesik, V. M. Sedykh, and B. V. Kondrat'yev *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Waveguides 9 Aug. 1966 p 7-13 refs (See N66-34655 20-09) CFSTI: $2.00

Day. Sect. on Waveguides 9 Aug. 1966 p 7-13 refs (See N66-34655 20-09) CFSTI: $2.00

The wave impedance of an asymmetrical strip line for the case of wide conducting plates with arbitrary thickness is considered. The basic parameters of the line were obtained by conformal mapping using the Cristoffel-Schwartz integral. Formulas used in the integral calculations are shown, and graphs of various functions are presented. It is noted that the wave impedance of an asymmetrical line is much less dependent on the thickness of the conducting plate than a symmetrical line, and the effect of thickness is more pronounced in the region of large wave impedances or narrow plates. A.G.O.

N66-34658# Joint Publications Research Service, Washington, D. C.

A SHIELDED STRIP LINE WITH AN ASYMMETRICALLY-PLACED CONDUCTING PLATE OF FINITE THICKNESS

N. I. Lesik, V. M. Sedykh, and B. V. Kondrat'yev *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Waveguides 9 Aug. 1966 p 14-19 refs (See N66-34655 20-09) CFSTI: $2.00

Formulas and graphs are given which can be used to determine the wave impedance of a shielded strip line with a conducting plate of arbitrary thickness. The wave impedance and other line parameters are expressed in terms of the electrostatic complex potential, which is determined by the conformal mapping method. The derivation of the mapping integral and the numerical calculations for the wave impedance and capacitance of the line are shown, and a graphical representation is included. A.G.O.

N66-34661# Joint Publications Research Service, Washington, D. C.

ELECTROMAGNETIC WAVE PROPAGATION IN A SHIELDED HELICAL LINE WITH A DIELECTRIC CORE ALLOWING FOR THE FINITE CONDUCTANCE OF THE HELIX

S. A. Vyshinskiy *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Waveguides 9 Aug. 1966 p 22-27 refs (See N66-34655 20-09) CFSTI: $2.00

A shielded helical line with a dielectric core allowing for the finite conductance of the helical conductor is analyzed, and the problem of calculating the parameters of a helical line is solved. The characteristic equation for the symmetrical wave is derived, and approximate formulas for attenuation and pinch factors are given. The determination of wave impedance is shown, and theoretical and experimental values for the input impedance are compared. It is pointed out that the results obtained can also be used to solve problems in designing a line for given electrical characteristics, which is applicable in creating wideband equivalent antennas. A.G.O.

N66-34660*# ITT Industrial Labs., Fort Wayne, Ind.

RESEARCH IN THE DEVELOPMENT EFFORT OF AN IMPROVED MULTIPLIER PHOTOTUBE Seventh Quarterly Report

F. H. Barr and E. H. Eberhardt 24 Jun. 1966 37 p refs (Contract NASw-1038)

(NASA-CR-77185; ITTIL-66-1037) CFSTI: HC $2.00/MF $0.50 CSCL 09A

Test data are presented on a sampling of multiplier phototubes having an 0.5 inch effective diameter cathode, and a 12-stage multiplier. To determine the effective photocathode size and the response uniformity, the photocathode was mechanically scanned with a small spot of light while the output of the multiplier was monitored with a dc oscilloscope. These data are plotted as a function of displacement along two mutually orthogonal diameters, one of which is parallel to dynode one; results show that the effective cathode dimensions are about 0.6 by 0.5 inch when measured at the half amplitude points of these curves. Response time characteristics, and pulse amplitude distribution characteristics are measured, and the findings presented graphically. Also discussed are efforts directed toward more efficient use of the incoming radiation at the photocathode in order to improve the quantum efficiency of multiplier phototubes. M.G.J.

N66-34704*# Bendix Corp., Southfield, Mich. Research Labs. Div.

STUDY TO INVESTIGATE THE EFFECTS OF IONIZING RADIATION ON TRANSISTOR SURFACES Third Quarterly Report, Period Ending 31 Mar. 1966

Richard J. Sweet and David L. Nelson May 1966 41 p refs *Its* Rept.-3434

(Contract NAS8-20135)

(NASA-CR-77360) CFSTI: HC $2.00/MF $0.50 CSCL 09A

A summary is presented of the results from a program conducted to delineate the effects of ionizing radiation on transistor surfaces. The areas of investigation included electrical bias effects, time-dose relationships, recovery effects, temperature-ionization relationships, and irradiation of evacuated devices. The tests conducted are described briefly, and tables and graphs which summarize the data obtained are provided. It is stated that the methods producing the effects were characterized, models which describe the physical phenomena were established, nondestructive screening techniques for separating transistors with good immunity from those with poor immunity were developed, and surface treatments or manufacturing processes which may lead to a minimum of ionizing radiation surface effects were evaluated. H.S.W.

N66-34739# Brookhaven National Lab., Upton, N. Y.
HIGH-CURRENT SWITCH WITH BUILT-IN LINEAR TIMER (IH-388 AND IH-358)
J. P. Palmer and S. C. Goscinski 20 May 1965 6 p
(Contract AT(30-2)-GEN-16)
(BNL-9241) CFSTI: HC $1.00/MF $0.50

A simple, fast high-current switch is described for heating a filament to a controlled high temperature for a controlled time for studies of chemical reactions. The switch includes a simple S.C.R. scaler in which a graphite filament is the load of a 120-amp S.C.R., and a smaller S.C.R. is used to control the length of time the larger unit is allowed to conduct. The linear timer is a "one-shot" univibrator. Long-time firing pulses can be applied to the switch as well as the shorter pulses from the linear timer. NSA

N66-34887# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
PRODUCTION ENGINEERING MEASURE FOR INSULATED GATEFIELD EFFECT TRANSISTORS First Quarterly Progress Report, 30 Nov. 1965–28 Feb. 1966
James George and Dale Reinke [1966] 63 p
(Contract DA-36-039-AMC-06174(E))
(M-18; AD-634828) CFSTI: HC $3.00/MF $0.75

A complete basic design is presented for the high frequency insulated gate field effect transistor. MOS stability is examined and a general failure mode discussion is presented. It is found that most noncatastrophic failures result from the movement of charged ionic species in the gate oxide. In order to minimize this instability different stabilizing techniques are reported with emphasis on those applicable to the MOS production area. The effect of various etches, solvents, and rinses on device stability and performance are listed, and results are presented on the difference in processing sequences such as hot evaporation and cold evaporation, with and without a phosphorus-stabilized system. The production sequence for the rf MOSFET is listed as well as progress in improved packaging techniques. Final probing and testing capabilities for the rf MOS device are outlined. Author (TAB)

N66-34890# Lenkurt Electric Co., San Carlos, Calif.
NETWORK GROUP, HYBRID CIRCUIT OA-7424(XW-1)/FCC-17 (FOUR-WIRE TERMINATION SET)
Forrest W. Easley and T. R. Holmes Griffiss AFB, N. Y., RADC, 20 May 1966 28 p refs
(Contract AF 30(635)-11188)
(RADC-TDR-63-529, Vol. II; AD-634829) CFSTI: HC $2.00/MF $0.50

This report contains a summary of the category I testing of the four-wire termination set. This equipment was fabricated under the Phase B provisions in contract AF 30(635)-11188 and was designed and developed for use with the multiplexer set AN/FCC-17 to provide two-wire termination for 12 four-wire voice frequency circuits. The category I testing phase of the four-wire termination set development was accomplished to determine compliance with design requirements of Lenkurt specification 805-02735 and to evaluate the performance of the four-wire termination set Phase B equipment. After testing the Phase B equipment in accordance with the category I test plan, it is concluded that the equipment is highly reliable and fully compatible with multiplexer set AN/FCC-17 and is fully within the specifications set forth in Lenkurt specification 805-02735. Author (TAB)

N66-34891# ITT Electron Tube Div., Roanoke, Va.
PRODUCTION ENGINEERING MEASURE FOR TYPE FW-202 BARRIER GRID STORAGE TUBE Quarterly Progress Report, Jan. 1–Mar. 31, 1965
J. D. Hagan [1965] 19 p
(Contract DA-36-039-SC-85967)
(QPR-15; AD-633734) CFSTI: HC $1.00/MF $0.50

The pilot production phase of the program was completed. Sixty-nine barrier grid tubes passed complete specification testing and were placed in stock. The low beam current problem was resolved and the single beaded barrier grid gun is now a standard, reliable assembly. The major cause of reject tubes remains defective targets. Although the situation was somewhat improved during this quarter, some further work is still needed in this area, if tube yields above the current 35% to 40% are to be realized. Author (TAB)

N66-34916# Martin Co., Baltimore, Md.
RADIATION EFFECTS ON INSULATED GATE FIELD EFFECT (MOS) INTEGRATED CIRCUITS Third Quarterly Report, 1 Jan.–31 Mar. 1966
David M. Long and H. L. Flescher Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 24 p refs
(Contract DA-28-043-AMC-01520(E))
(MND-3264-3; ECOM-01520-3; AD-635198) CFSTI: HC $1.00/MF $0.50

A report is given which covers the third quarter's effort of a radiation effects study on insulated gate field effect MOS integrated circuits. The activity for the quarter was concentrated on pulsed radiation testing at the Martin flash X-ray facility and Rensselaer Polytechnic Institute linear accelerator facility, and on the preparation for neutron tests at DORF. The date reported here are for the transient current response of the gate or drain lead of a 'dummy' MOS device packaged in a TO-5 can and an empty TO-5 socket, as a function of bias, and for the transient response of the gate or drain lead of six n-channel depletion and eight p-channel enhancement MOS transistors. The peak transient drain current for the p-channel units was measured to range from −460 to +620 microamperes and from 110 to 700 microamperes for the n-channel units. The data were taken at 1.6×10^7r/sec with the magnitude and duration of the response being a function of gate resistance and gate voltage. Measurements of the response of specially fabricated 'dummy' MOS devices have demonstrated that the devices tested have a larger response (300 microamperes) when leads are positively biased than when the leads are negatively bias (−78 microamperes). The data also show that the current response is nonlinear with voltage and that interaction between leads can occur. This interaction is a function of the relative magnitude and polarity of the bias on adjacent leads. Author (TAB)

N66-34949# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
RESEARCH FOR DEVELOPMENT OF EPITAXIAL TECHNIQUES FOR USE IN FABRICATION OF SILICON CARBIDE DEVICES Final Scientific Report, 1 Feb. 1965–31 Jan. 1966
Don M. Jackson Bedford, Mass., AFCRL, 13 May 1966 64 p refs
(Contract AF 19(628)-4802)
(AFCRL-66-400; AD-635135) CFSTI: HC $6.00/MF $0.75

Attempts were made to fabricate p-n junction diodes and SiC channel isolated-gate field-effect transistors. P-type doping was not possible and, consequently, the p-n junction work was terminated without success. Attempts to make n-channel, SiC IGFET's on silicon substrates were not successful, nor were attempts to fabricate the same structures on sapphire substrates. Silicon IGFET structures with acceptable device quality parameters were grown using identical techniques, demonstrating the feasibility of the approach. No acceptable SiC device characteristics were demonstrated during this contract. This could be attributed to poor structure quality, or the

presence of an anomaly such as impurity bands which would inhibit device action. Author (TAB)

N66-34952# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MATERIALS USED IN RADIO ELECTRONICS

A. G. Sobolevskiy 11 Feb. 1966 58 p Transl. into ENGLISH of the book "Materialy v Radioelektronike" Moscow, Gos. Energ. Izd., 1963 p 1–48

(FTD-MT-65-69; AD-635271) CFSTI: HC $4.00/MF $0.50

Reference book contains information about materials with which the radio amateur deals during the designing of radio equipment: conductors, dielectric, structural metals and insulating material, low-frequency and high-frequency magnetic materials, and also different auxiliary materials—adhesives, wood, lacquers, and enamels. The book is intended for amateur radio designers. Author (TAB)

N66-34953# Radio Corp. of America, Camden, N. J. Defense Electronic Products.

MICROELECTRONIC SOLID-STATE DISPLAY ASSEMBLY Final Development Report, 8 Jun. 1965–7 Jul. 1966

[1966] 186 p

(Contract NObsr-93320)

(AD-634911) CFSTI: HC $5.00/MF $1.00

The purpose of this program was to perform configuration and fabrication studies which might improve the performance of CdSe-EL display panels. Treatment parameters, handling, and conditions of application of the CdSe were also studied with regard to their influence on the variability of the hysteresis effect. The configuration studies included a comparison of the sandwich structure and gap structure constructions of CdSe-EL panels. The sandwich structure was found to be more practical to fabricate. The fabrication techniques that were investigated included studies on binders, solvents, curing procedures, temperature and humidity effects, postfire treatments, sizes and types of wire electrodes, packing density, the occurrence of electrical and optical cross-coupling of CdSe-EL panels was also performed. The most significant results were obtained in the postfire treatment experiments and in the investigations of cross-coupling. As found in the postfire treatments, the proper treatment can increase the threshold to cutoff ratio of a particular batch of CdSe. It was also found that various specific treatments can reduce the degree of variation (in hysteretic behavior) from batch to batch. The investigations of cross-coupling showed that better performance can be obtained from CdSe-EL panels if electrical and optical isolation between CdSe elements is provided. Author (TAB)

N66-34960# Westinghouse Electric Corp., Elkridge, Md. Molecular Electronics Div.

MOS INTEGRATED CIRCUITS Third Quarterly Report, 1 Jan.–31 Mar. 1966

Tom Sikina, Joe Tsai, Herman Van Beek, and C. Roe Jun. 1966 38 p ref

(Contract DA-28-043-AMC-01515(E))

(ECOM-01515-3; AD-635190) CFSTI: HC $3.00/MF $0.50

The report contains the results on the process improvements to develop an integrated semiconductor memory utilizing complementary MOS transistors. Various factors which affect process control were investigated. An optimum structure for obtaining complementary regions of p-type and n-type silicon is given. Complementary pairs of normally-off n-channel and p-channel devices were obtained both on separate and on a single substrate material. The cleanliness during the process is an important factor which affects the reproducibility and the uniformity of the device characteristics. Author (TAB)

N66-34966# Weston Instruments, Inc., Archbald, Pa.

PRODUCTION FACILITIES FOR MULTI-TURN METAL-FILM TRIMMER RESISTORS PER SIGNAL CORPS TECHNICAL REQUIREMENTS SCS-127 AND MIL-R-22097B (MODIFIED) Quarterly Progress Report, Jul. 1–Sep. 30, 1965

[1965] 37 p

(Contract DA-36-039-SC-86734(E))

(QPR-13; AD-635129) CFSTI: HC $2.00/MF $0.50

Methods for chemical analysis of all ingredients in the metallizing bath were developed and are being incorporated in the control procedure. The experimental effort for the bath variable study was completed with the exception of wear testing. The data has not been completely evaluated, however, useful information has been obtained. Certain additional work based on the partial results is already in progress. A number of heat treatments were tried to improve wear resistance. The results were encouraging but the ability to predictably reproduce satisfactory wear resistance has not been attained. A study was initiated on the effects of heat treatment and film wear on high temperature exposure tests. Sample "O" rings were received and evaluated as a means of improving the seal on the potentiometer. Results to date are promising but further work is needed. Author (TAB)

N66-34967# Weston Instruments, Inc., Archbald, Pa.

PRODUCTION FACILITIES FOR MULTI-TURN METAL-FILM TRIMMER RESISTORS PER SIGNAL CORPS TECHNICAL REQUIREMENTS SCS-127 DATED 9 FEBRUARY 1962 AND MIL-R-22097B (MODIFIED) Quarterly Progress Report, Apr. 1–Jun. 30, 1965

[1965] 18 p

(Contract DA-36-039-SC-86734(E))

(QPR-12; AD-635128) CFSTI: HC $1.00/MF $0.50

Analytical methods were developed for all but one ingredient in the bath from which the film is deposited. Analytical procedures for evaluation of the deposited film were developed and are ready for use during subsequent work requiring analysis of the effects of film application variables. A piece of equipment was designed and made for analysis of wear characteristics of the film. Some study of the wear resistance was performed. Baths were run with newly available controls and an improved consistency of results obtained. Because methods for analyzing all ingredients of the bath are not yet available, it has not been possible to have complete control over the deposition of the film. Baths have been run omitting the ingredients for which the analytical methods were not available. These baths proved to be impractical for production usage. Fundamental studies were made on the heat treating of the film. Various methods of terminating were evaluated and the method previously in use remains the best. Further studies of film variation as a result of the method of termination indicates that the variations previously suspected could not in fact be attributed to the method of termination. Author (TAB)

N66-34984# Northrop Corp., Newbury Park, Calif. Applied Research Dept.

STUDY FOR GENERALIZED MODEL FOR SEMICONDUCTOR RADIATION RESPONSE PREDICTION Fourth Quarterly Progress Report, 15 Sep. 1965–15 Feb. 1966

J. P. Raymond and R. E. Johnson Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 158 p refs *Its* Rept.-4

(Contract DA-28-043-AMC-00423(E))

(ARD-66-29R; ECOM-00423-4; AD-635228) CFSTI: HC $5.00/MF $1.00

This report summarizes the previous year's work, as well as presenting developments during the fourth quarter. The

detailed transistor study is emphasized, and shows that the accuracy of the calculated results depends on the accuracy of the calculated primary photocurrent and on the accuracy of the lumped-model parameters in representing the electrical behavior. If the common-emitter ionizing-radiation transient response is calculated without prior ionizing radiation experiments, the calculated result is generally lower than the observed response by about a factor of three over the range of common-emitter circuit parameters. If the internal carrier generation rates are adjusted such that the observed collector primary photocurrent agrees with the calculated waveform, the calculated common-emitter transistor response accurately follows the observed response. Here, accuracy means certainly less than a factor of two in the worst combination of external circuit parameters, and usually much better than a factor of two. The accuracy is limited by the detail of the representation of the transistor electrical parameters. The lumped-model representation of the transistor can accurately predict the critical electrical and ionizing-radiation induced transient response of widely varying types of devices. TAB

N66-35079# Philco Corp., Lansdale, Pa.
LOW COST INTEGRATED CIRCUIT TECHNIQUES Third Quarterly Progress Report, 15 Dec. 1965–14 Mar. 1966
Sturger Wagner and Mauro Walker Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 44 p
(Contract DA-28-043-AMC-01424(E))
(ECOM-01424-3; AD-635183) CFSTI: HC $2.00/MF $0.50

Evaluation studies of evaporated and vapor plated glass have led to the recommendation that only the vapor plated glass process be used in continuing the remainder of the program. Vapor plated glass has shown superior properties as a dielectric and in mobile charge content. An important consideration is the compatibility of vapor plated glass with existing metalization systems. A number of construction methods have been evolved and proven feasible, although several problems remain. However, the problems are basically those of processing and thus capable of resolution during fabrication of the test vehicles. Continued improvements in batch assembly techniques have led to more reproducible and better defined solder joints. Further electrical evaluations have been made of devices to determine the effects of glassing. These evaluations have also evidenced the superiority of vapor plated glass. An error in one of the masks proved to be responsible for a saturation voltage problem. A specification question has arisen because of the rather wide range of leakage currents resulting from gold doping. This leakage current variation made the test vehicles which were constructed unsatisfactory for environmental testing. A revised approach to the final exploratory development models is recommended to permit emphasis on the construction techniques which utilize vapor plated glass. Author (TAB)

N66-35101# Hughes Aircraft Co., Fullerton, Calif.
EFFECT OF TRANSISTOR DESIGN PARAMETERS ON RADIATION RESPONSE (POWER TRANSISTORS) Third Quarterly Report, 1 Jan.–31 Mar. 1966
Vincent R. Honnold, Gary D. Thomas, and Jerome J. Mazenko Fort Monmouth, N. J., Army Electron. Command, Jul. 1966 21 p refs *Its* Rept.-3
(Contract DA-28-043-AMC-01541(E))
(FR-66-17-182; ECOM-01541-3; AD-635218) CFSTI: HC $1.00/MF $0.50

The objective of the program is to determine particular design characteristics and fabrication techniques for a silicon planar power transistor that will minimize the effects of ionization and lattice displacements caused by high energy radiation. The third quarter was devoted to writing a digital computer program to perform an analysis of variance on the experimental data previously obtained and performing the irradiations on the first group of experimental devices. The report describes the experimental procedure used in conducting the neutron irradiation, the writing of the digital computer program and its checkout, and, finally, a sample analysis of variance at a low injection level. Author (TAB)

N66-35117# Norwegian Defence Research Establishment, Kjeller.
ACOUSTIC AMPLIFICATION—A DISCUSSION OF APPLICATIONS Interim Scientific Report No. 11
Kjell Blotekjaer 15 Jan. 1966 43 p refs
(Contract AF 61(052)-484)
(E-74; AFCRL-66-431; AD-634788) CFSTI: HC $2.00/MF $0.50

Based on the present theoretical and experimental knowledge of the piezoelectric ultrasonic amplifier, various applications are considered. Properties which are of importance for design of practical devices are discussed, and fundamental limitations are pointed out, paramount among these are the high power consumption and low efficiency. Due to the inherent acoustic nature of the amplifier, ultrasonic devices such as active transducers and delay lines seem more promising than amplifiers for electric signals. A few unconventional designs are proposed. Author (TAB)

N66-35152# Radio Corp. of America, New York. Communications Systems Div.
HIGH PERFORMANCE THIN FILMS FOR MICROCIRCUITS (CAPACITORS) Fourth Quarterly Progress Report, 1 Dec. 1965–28 Feb. 1966
Franz Huber and Walter Witt Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 48 p refs *Its* Rept.-4
(Contract DA-28-043-AMC-01230(E))
(ECOM-01230-4; AD-635298) CFSTI: HC $2.00/MF $0.50

The report includes experimental results of the first twelve month's investigation of the fabrication of thin film hafnium-hafnium dioxide capacitors. Sputtered hafnium films were deposited on glass and anodized by both wet and plasma anodization processes. Wet anodization offers the advantage of larger range of forming voltage (up to 250v) as compared to the maximum forming voltage of about 60 for the plasmionic process. The temperature coefficient of capacitance has been measured to be +124 ppm/°C over the temperature range from −196°C to 300°C, and as low as +40 ppm/°C over smaller temperature ranges (+25°C to 125°C). Up to several hundred kHz, the capacitance is practically frequency insensitive and a Q of 50 has been measured at 22 MHz. Breakdown voltages frequently exceed the forming voltage by 50% or more. Life test data for wet anodized capacitors indicate changes less than 1% over several thousand test hours at room temperature of at 125°C. The wet anodized capacitors exhibit small leakage currents (10^{-8} to 10^{-12} A/mm^2) in the forward and backward direction, practically without preferred current flow in either direction. A dielectric constant of 45 was measured for the hafnium oxide. TAB

N66-35153# Syracuse Univ. Research Inst., N. Y.
HETEROJUNCTION DEVICES Interim Report, 1 Dec. 1964–30 Nov. 1965
Richard L. Anderson, Girtz Zeidenbergs, S. Yawata, T. Huang, D. Boyce et al Griffiss AFB, N. Y., RADC, Jun. 1966 188 p refs
(Contract AF 30(602)-3637)
(AR1-65; RADC-TR-66-8; AD-635026) CFSTI: HC $1.50/MF $1.00

Using tellurium as a transport agent, n- and p-type silicon was deposited on n- and p-type GaP. Heterojunction devices of these deposits were made. Their electrical and optical characteristics were determined, and energy band profiles, as well as current carrying mechanisms, are proposed to explain the majority of the experimental results. The deposition of Si upon GaP is carried out in a closed ampoule at about 850°C. Transport of Si is believed to be due to temperature dependence of equilibrium constant of a chemical reaction involving silicon telluride compounds. The I-V characteristics with and without light, photocurrent-photo energy spectra for both bias polarities, and capacitance-voltage characteristics with and without light applied are discussed. Preliminary results on epitaxial deposition of Ge on Si are presented. In this epitaxial deposition process, GeC_{14} is used as source while Si substrates are used as seeds. Adequately thick and smooth deposits were obtained. Electrical and photo-conductivity measurements seem to indicate the existence of heterojunctions.

Author (TAB)

N66-35194# Queens Univ., Kingston (Ontario). Dept. of Electrical Engineering.

ON FREQUENCY-MODULATION SPECTRA AND THE DISTRIBUTION OF A FUNCTIONAL OF THE MODULATING PROCESS

Paul H. Wittke Apr. 1966 163 p refs

(Contract DRB-5130-03)

(RR-66-1) CFSTI: HC $5.00/MF $1.00

The distribution of the functional $z(\tau)$ is discussed, where $z(\tau)=\int_0^\tau V(y(t))dt, V(y)$ is the arbitrary tuning characteristic, and y(t) is the random modulating signal. The spectra for frequency modulation by random signals are also considered, and spectra for FM by binary signals are obtained. An example is given for the solution obtaining expressions for the characteristic function of $z(\tau)$ and the FM autocorrelation function for a signal with an exponential autocorrelation function. The solution of the integral equation and boundary value problems is presented for the case when y(t) is a Markov process for a general nonlinearity V. The quadratic nonlinearity and the infinite clipper boundary value problem are examined. Perturbation techniques are suggested, and perturbation on a linear characteristic is presented. Calculations are carried out for quadratic, cubic, and exponential perturbations. N.E.N.

N66-35232*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

ELECTROFLUID CONVERTER Final Report, 25 Jun. 1965-25 Mar. 1966

25 Mar. 1966 62 p refs

(Contract NAS8-11924)

(NASA-CR-77547; LMSC/HREC-A782436; HREC-11924-1) CFSTI: HC $3.00/MF $0.75 CSCL 09C

An electric-to-fluid signal converter, suitable for driving a proportional pure fluid amplifier, is described. The electrofluid converter model types investigated and fabricated are: (1) flapper valve, (2) acoustical driver, (3) movable nozzle, and (4) deflectable splitter. The first three were successfully demonstrated, and the flapper valve model was chosen for further modification. Modulation and control of fluidic devices was accomplished by use of piezoelectric elements. Details are presented on the designs and testing. N.E.N.

N66-35240*# Montana State Coll., Bozeman. Dept. of Mathematics.

INVESTIGATIONS ON NONPARAMETRIC DISCRIMINATION THEORY AND PROCEDURES APPLICABLE TO PROBLEMS IN ELECTRONIC COMPONENT SCREENING. ON DISCRIMINATION PROBLEMS Final Report

C. P. Queenberry and Margaret Gessaman Aug. 1966 47 p refs

(Grant NsG-562)

(NASA-CR-77478) CFSTI: HC $2.00/MF $0.50 CSCL 09A

The results of research effort to obtain discrimination procedures which would be useful and valid for general models are reported. The basic model, allowing more decisions than the usual forced classification model, and the general problem are discussed. A theoretical solution for the case of two known continuous distributions along with some particular examples are presented. Definitions of consistency for sequences based on samples are given. A general approach for constructing nonparametric discrimination procedures is described. Particular procedures are considered which are consistent with best known distribution procedures, and some parametric results are also included. N.E.N.

N66-35264# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

APPLICATION OF NEW FAST-ELECTRONIC TECHNIQUES TO THE DETERMINATION OF THE EXACT MOMENT OF PARTICLE DETECTION [APPLICATION DES TECHNIQUES NOUVELLES DE L'ELECTRONIQUE RAPIDE A LA DETERMINATION DE L'INSTANT PRECIS DE DETECTION D'UME PARTICULE]

Michel Hesse (Ph.D. Thesis—Lyon Univ.) 1966 61 p refs In FRENCH

(CEA-R-2885)

Fluctuations in the time response of photomultipliers employed in scintillation counting are studied and experimentally checked. Statistical measurements of the output pulses show that the relative variance of the time fluctuations is minimum for the portion located around the bending point of the leading edge. A shaping circuit using this property is described. Experimental results are given, showing an improvement of the resolving time. Author (NSA)

N66-35345# Syracuse Univ. Research Corp., N. Y. Defense Systems Lab.

INSTALLATION AND ENVIRONMENTAL TEST OF LIGHT SIGNAL MONITOR FACILITY AN/TSQ-( )

Gordon H. La Tourette 1 Jun. 1966 46 p

(Contract N00014-66-C0118)

(DSL-R-146; AD-634991) CFSTI: HC $2.00/MF $0.50

A prototype light signal monitor facility AN/TSQ-( ) was subjected to specified shock, vibration, and environmental testing at Albany, Georgia. The system met or exceeded the requirements of all tests to which it was subjected. Although minor damage was sustained by the shelter as a result of the drop test, the electronic equipment continued to operate properly. A transistor failure experienced in the AN/PRC-47 radio set when it was switched to high power was determined to be unrelated to the system testing. Comments on the testing and recommendations for procurement systems are included.

Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-34119# Illinois Univ., Urbana. Coordinated Science Lab.

A TOPOLOGICAL APPROACH TO THE STABILITY OF TIME-VARYING AND NONLINEAR NETWORKS

Tadao Murata (Ph.D. Thesis) May 1966 67 p refs
(Contract DA-28-043-AMC-00073(E); Grant AF-AFOSR-31-65)
(R-291; AD-634366) CFSTI: HC $3.00/MF $0.75

New techniques are presented which provide stability information for time-varying and nonlinear networks by inspection of the topology and the element values of the network. The derivation of the new techniques is based on Liapunov's second method for time-varying networks, his first method for nonlinear networks and network topology. More specifically, Liapunov's stability theorems of linear time-varying RLC networks are formulated in terms of the tree or chord–set products of the subnetworks derived from the state-space representation of the general networks. The local stability theorems of nonlinear time-invariant RC and RL networks are formulated in terms of the tree or chord-set products of subnetworks. Four examples are given to illustrate the above theorems. Author (TAB)

N66-34168# Illinois Univ., Urbana. Coordinated Science Lab.
NONLINEAR PROGRAMMING AND MULTIPARAMETER SENSITIVITY IN LINEAR TIME-INVARIANT NETWORKS
Gerry L. Kelly Jun. 1966 72 p refs
(Contract DA-28-043-AMC-00073(E))
(R-301; AD-634367) CFSTI: HC $3.00/MF $0.75

A computational solution is obtained to the multiparameter sensitivity problem for linear time-invariant networks in which large element variations are permitted. The various definitions of multiparameter sensitivity are critically reviewed and it is concluded that a definition which was proposed by Hakimi and Cruz is currently the most general since the other definitions are valid only for small variations in the network element values. Their definition of multiparameter sensitivity is extended to a measure over a band of frequencies and to such cases as n-port networks where it is desirable to consider more than one transfer function. A method is presented for the selection of the temperature coefficients of active-RLC networks to reduce multiparameter sensitivity. A second-order approximation to the network function variation is studied by considering the first three terms of a Taylor series expansion. A Mikulski-Ur type of correlation is obtained between the third Taylor series term and the classical root sensitivities. Also the first three Taylor series terms are related to the K-trees which Hakimi and Green defined. Blostein's results relating the sum of classical Bode sensitivity functions to the first derivative with respect to complex frequency is extended to the second derivative and n-th derivative cases.
Author (TAB)

N66-34332# Joint Publications Research Service, Washington, D. C.
ANALYSIS OF DIODE LOGICAL CONVERTER NETWORKS
N. P. Markin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 17–23 refs (See N66-34328 20-08) CFSTI: $3.00

A general discussion is presented of logical converters whose output functions are characterized by single obligatory constituents. These converters are used primarily in contactless automatic telephone system locators in which a changeover from binary to decimal code must be made. An analysis is made of converter for which each input function is determined by a single state of input variables, and the different design variants are examined when there are four input variables. Attention is also given to determining the number of output variables and the number of diode changes. It is shown that both multistage pyramidal and cascade networks can be obtained, and the method for constructing both is given. A two-group, two-stage network is found to contain the least number of diodes and, therefore, is most economical. M.W.R.

N66-34333# Joint Publications Research Service, Washington, D. C.
TRANSISTORIZED TUNNEL DIODE ELECTRONIC COUNTERS
V. V. Klimov and Ya. V. Kovalin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 24–28 refs (See N66-34328 20-08) CFSTI: $3.00

Two electronic circuits are described: one is designed with flip-flops with a single tunnel diode and amplifiers with transistors having a common emitter; the other, designed with tunnel diodes and transistors, uses flip-flops with a counter input. Circuit operations are included and details are presented for the ring counter employed in these transistorized tunnel diode electronic counters. M.W.R.

N66-34335# Joint Publications Research Service, Washington, D. C.
PRACTICAL NETWORKS OF TUNNEL DIODE PULSE UNITS
M. I. Andreyev *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 36–41 (See N66-34328 20-08) CFSTI: $3.00

An examination is made of practical networks of several pulse units with tunnel diodes alone or with tunnel diodes and transistors. It is noted that experimental findings indicate that transistors in combination with inverted diodes permit the construction of high speed pulse units, such as switches or inverters; and a diagram illustrates a flip-flop, reset, and firing for creating pulses of positive polarity fed to various inputs. This results in an improvement in shape of output pulse. It is also noted that if a nonlinear inverse feedback is introduced into the flip-flop by switching, there is a reduction in the trailing edge of the pulse. M.W.R.

N66-34337# Joint Publications Research Service, Washington, D. C.
RESEARCH ON RADIO PULSE TUNNEL DIODE MULTIFREQUENCY TRIGGER
S. S. Garmatyuk *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 47–51 refs (See N66-34328 20-08) CFSTI: $3.00

The principle of flip-flop operation is described, methods for study flip-flop circuits are considered, and basic results from the study of frequency flip-flop circuits are given in relation to usage in automated computer systems with frequency recording of information. Because an oscillating system with concentrated parameters and a cyclic amplitude modulation are used, the described flip-flop has smaller dimensions and is controlled by a higher quality signal of less power than similar devices. It is concluded that such flip-flops may be possible in the gigacycle range with five to ten steady states. High speed operation and noise resistance can be increased by operation in a soft regime area. Disadvantages of the frequency flip-flop are the need for wider frequency bands and the comparative complexity of the multiresonant oscillator system. M.W.R.

N66-34338# Joint Publications Research Service, Washington, D. C.
CALCULATING OPTIMUM PARAMETERS OF RADIO-ELECTRO-TECHNICAL UNITS WITH THE AID OF AN ELECTRONIC DIGITAL COMPUTER
D. I. Batishchev *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Electron. Computer Tech. 3 Aug. 1966 p 52–58 (See N66-34328 20-08) CFSTI: $3.00

Mathematical methods are employed for the digital computer solution of extremum problems in the selection of optimum parameters for radio and electronic units. It is noted that the achievement of true optimum design is almost impossible because it must take into account minimum weight

and dimensions, high reliability in operation and high technical quality, low manufacturing cost, and easy operation. Consequently, the emphasis is on the selection of optimum parameters which will permit maximum efficiency; and the equipment is tested under the worst possible conditions to increase inherent operational reliability. The problem of optimum planning and design is reduced to one of nonlinear programming, with the calculation of two specific problems presented to illustrate the procedure: (1) optimum winding for a dc electromagnetic relay and (2) optimum transistor-rheostat logical network, called OR-NOT, which provides reliable operation of the element at maximum high speed.

M.W.R.

N66-34353# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY: CYBERNETICS SECTION

1 Aug. 1966 82 p refs Transl. into ENGLISH from XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyaschennaya Dnyu Radio. Sektsiya Kibernetiki (Moscow), 1966 p 3–72 (JPRS-36755; TT-66-33186) CFSTI: $3.00

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2. SOLUTION OF A SINGLE PROBLEM OF CHOOSING ELEMENTS OF A SYSTEM BY PREDICATE CALCULUS V. I. Gofman p 6–10 refs (See N66-34355 20-10)

3. SEVERAL PROPERTIES OF AN OPTIMAL TWO-STEP PROCEDURE FOR DIFFERENTIATING BETWEEN STATISTICAL HYPOTHESES Yu. B. Sindler p 11–17 refs (See N66-34356 20-19)

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12. PROBABILITY PREDICTING A. V. Mozgalevskiy and D. V. Gaskarov p 55–62 refs (See N66-34363 20-10)

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N66-34354# Joint Publications Research Service, Washington, D. C.

PROVIDING FOR PREDETERMINED HIGH SPEED OPERATION OF DISCRETE AUTOMATA WITH SIMULTANEOUS ELIMINATION OF CRITICAL FEATURES

E. B. Yershova *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 1–5 refs (See N66-34353 20-10) CFSTI: $3.00

The problems involved in providing predetermined, high speed, reliable operation of automata by electronic digital computers are examined at the stage of coding internal states. Basic definitions and corallaries used in the analysis are presented, and the addition and multiplication operations used with δ partitions are described. On the basis of the properties established for δ partitions and the use of the multiplication and addition operations, an algorithm is constructed for coding which permits assurance of automaton high speed operation, and removes the critical features of its storage elements.

A.G.O.

N66-34355# Joint Publications Research Service, Washington, D. C.

SOLUTION OF A SINGLE PROBLEM OF CHOOSING ELEMENTS OF A SYSTEM BY PREDICATE CALCULUS

V. I. Gofman *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 6–10 refs (See N66-34353 20-10) CFSTI: $3.00

Although the use of monotopic unified elements leads to an increase in reliability and ease of system assembly, the problem arises of a reduction in the number of element parts. This problem is examined by the application of predicate calculus methods for a system consisting of a number of subsystems with a choice of elements limited by specific conditions. By means of sequential elementary calculus a complex predicate which corresponds to conditions of the problem was found, and the predicate has been transformed into an abbreviated disjunctive form. Prime implicants which make up this form correspond to the complete ensemble of closed sets of the element types. Minima of the closed sets are the unknown sets.

A.G.O.

N66-34359# Joint Publications Research Service, Washington, D. C.

LOGICAL ANALYZERS OF HYPOTHESES (LAH)

I. M. Romanov and I. S. Nugmanov *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 28–34 refs (See N66-34353 20-10) CFSTI: $3.00

The theoretical basis is presented for the operating principles of a device which can be used for checking hypotheses in the sequential analysis of random events. Two algorithms are given, with the aid of which it is possible to make decisions and to communicate short messages on the principles of designing the logical analyzer of hypotheses (LAH). The development of the algorithms including mapping of inequalities, analytical calculations, and probability determinations is shown, and the (LAH) device is diagrammed. It is noted that the same algorithms can be realized with the use of a digital computer.

A.G.O.

N66-34362# Joint Publications Research Service, Washington, D. C.

SEVERAL PROBLEMS ON RELIABLE SYNTHESIS OF SYSTEMS WITH LINEAR RELATIONSHIPS BETWEEN EFFICIENCY AND OPERATING TIME

V. S. Minayev *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 48–54 (See N66-34353 20-10) CFSTI: $3.00

Several problems are analyzed on optimizing the reliable synthesis of systems with linear relationships between efficiency and operating time on the criterion of economic efficiency. The process of multiple sequential problem solving is presented

including the development of economic efficiency ratios, working time coefficient and optimal redundancy formulas, and reliability functions. A.G.O.

N66-34363# Joint Publications Research Service, Washington, D. C.

PROBABILITY PREDICTING

A. V. Mozgalevskiy and D. V. Gaskarov *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 55–62 refs (See N66-34353 20-10) CFSTI: $3.00

A mathematical method is considered for predicting the change of state of a system by using the theory of probability and probability prediction techniques. The formulated problem of predicting is given, and the solution of the two invariants within the problem is shown. The various integral calculations and transformations are demonstrated, and several graphs of the derived parameters are presented. An example using the plate-grid characteristics of pentodes is also included to illustrate the proposed method. A.G.O.

N66-34365# Naval Civil Enginnering Lab., Port Hueneme, Calif.

LOSSY CONDUCTORS FOR ATTENUATION OF POWER LINE INTERFERENCE Final Report, May 1962–Oct. 1964

D. B. Clark May 1966 72 p refs

(TR-444; AD-633850) CFSTI: HC $3.00/MF $0.75

The installation of overhead and underground lossy power conductors at the Hawaiian tracking station, South Point, Hawaii, has been tested, and the results show that the conducted and radiated interference from the power line are greatly reduced. Measurements of attenuated interference covered the frequency range from 14 kHz to 1,000 MHz. A comparison to previously installed lossy lines shows that the Hawaii line, composed of the latest development in lossy conductors, is the most effective in attenuating interference. Author (TAB)

N66-34490# Joint Publications Research Service, Washington, D. C.

THE GAME CONTROL SYSTEMS AND INFORMATION MODELS

V. P. Zinchenko and D. Yu. Panov *In its* Cybernetics and Automation 17 Aug. 1966 p 28–33 ref (See N66-34486 20-05) CFSTI: $6.00

Problems which arise in designing control systems are examined, with emphasis focused on the requirements of game control systems. These special characteristics are listed as adaptability to changing conditions; proximity of the information, logic, and executive processes with respect to time; complex coordination of different components, and diverse feedbacks covering all subassemblies. As man's role is of prime importance, it is pointed out that game system design should start with an examination of the functions he is to perform. The information model is considered to be the most important element in the system as the operator makes decisions based on the data received through it. Some considerations concerning their design are given, and a sequence of design work is outlined. M.G.J.

N66-34491# Joint Publications Research Service, Washington, D. C.

ON THE PROCESS OF SOLVING THE PROBLEMS IN THE COURSE OF CONTROLLING COMPLEX OBJECTS

Y. N. Pushkin *In its* Cybernetics and Automation 17 Aug. 1966 p 34–43 refs (See N66-34486 20-05) CFSTI: $6.00

Several approaches to the man and automation problem are critically assessed, and it is pointed out that effective thinking should be differentiated from various forms of reactive activity which is a component of many types of the operator's labor. Several examples of chess problems are cited to show that the organization of the experiment plays an important role in studying the process of problem solving by man. The theoretical and practical problems related to the psychology of effective thinking are discussed, and the recommendation is made that the concepts of sifting the variants, and of the labyrinth should be abandoned. M.G.J.

N66-34492# Joint Publications Research Service, Washington, D. C.

ON SOME PRINCIPLES OF THE SYNTHESIS OF THE SYSTEMS WHICH LEARN

V. N. Vapnik and A. Ya. Chervonenkis *In its* Cybernetics and Automation 17 Aug. 1966 p 44–49 (See N66-34486 20-05) CFSTI: $6.00

Several examples are given of analogies established between the problem of teaching the automatons and the design of the automatons which learn; and the development of the living learning systems and, in particular, of man. The formal scheme of training is examined, in which the learning device consists of two parts: one which realizes some behavior defined by an algorithm of interaction; and the other which changes this behavior based on an analysis of present behavior, accumulated information concerning former behaviors, and additional data on the object given by the instructor. Its development for machines and for living systems is described. Ways of teaching without an instructor, and of teaching the simulation of the object are also considered, along with the creation of machines which learn image recognition. The limitations connected with the evolutionary development of living organisms are discussed in detail; two cases are given as examples. M.G.J.

N66-34495# Joint Publications Research Service, Washington, D. C.

ON THE ENTROPY METHOD OF ANALYZING THE CONTROL CIRCUITS

Y. I. Nikolayev *In its* Cybernetics and Automation 17 Aug. 1966 p 68–84 refs (See N66-34486 20-05) CFSTI: $6.00

The concept of entropy for a message was utilized to analyze control circuits for the fluid levels in water systems. The level of organization for the considered system was characterized by the entropy of the set of states and its introduced control system provided an organizing base for the fluctuating range. Calculations on partially automated control circuits, in which a human operator performed a number of control functions, indicated that the time spent to identify the control signal is a function of the signal entropy at input, that the time for analyzing the signal is a function required for working out the resolution of the information, and that the time for forming a decision is a function of the entropy of the signal made up by the operator. Appendixed calculations pertain to operative control circuits for the superheated-steam temperature and steam pressure in front of turbine nozzles. G.G.

N66-34496# Joint Publications Research Service, Washington, D. C.

AN AUTOMATIC DEVICE FOR DETERMINING THE FUNCTIONAL CONDITION OF HUMAN OPERATOR

R. S. Dadashev and S. P. Khlebnikov *In its* Cybernetics and Automation 17 Aug. 1966 p 85–91 (See N66-34486 20-05) CFSTI: $6.00

Described is a device that determines the functional condition of a human operator during development of hypoxia by

characterizing the changes in bioelectric brain activity, the oxygen saturation of arterial blood, the respiratory motions of the chest, and arterial blood pressure. The device encorporates transmitters of the physiological parameters; bio-amplifier units; separation of informatory signs; a converter unit; a logical unit; and an output signal system. Block and functional diagrams of this apparatus show that the setting-in of the different stages of hypoxia, as recorded by the different sensors, are evaluated in the logical unit which in turn signals then the arrival of the successive stages of hypoxia and may indicate corresponding action. G.G.

N66-34646# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON MICROELECTRONICS

11 Aug. 1966 34 p refs Transl. into ENGLISH from the publ. "XXII Vsesoyuznaya Nauchnaya Sessiya Posvyashchennaya Dnyu Radio. Sektsiya Mikroelektroniky" Moscow, 1966 p 3-32

(JPRS-36954; TT-66-33384) CFSTI: $2.00

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1. INVESTIGATION OF PARAMETRONS BUILT WITH NEW TYPES OF NONLINEAR CAPACITANCES A. S. Berezin, T. S. Kudryashova, L. N. Patrikeyev, and V. D. Popov p 1-5 refs (See N66-34647 20-10)

2. FEASIBILITY OF USING THYRISTORS IN LOW VOLTAGE PULSE CIRCUIT V. I. Vaganov, V. A. Kuz'min, V. S. Pershenkov, and I. I. Shagurin p 5-10 (See N66-34648 20-09)

3. ON THE TRANSIENT PROCESS OF SWITCHING CONTROLLED p-n-p-n DIODES V. A. Kuz'min and V. S. Pershenkov p 10-15 refs (See N66-34649 20-10)

4. TWO-DIMENSIONAL THEORY OF THIN-FILM FIELD EFFECT AND MOS TRANSISTORS, ACCOUNTING FOR TRAPS Yu. S. Ryabinkin p 15-21 refs (See N66-34650 20-09)

5. CALCULATION OF THE VOLTAMPERE CHARACTERISTICS OF THIN-FILM DIELECTRIC TRIODE-ANALOGS Yu. S. Ryabinkin p 21-25 refs (See N66-34651 20-10)

N66-34647# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF PARAMETRONS BUILT WITH NEW TYPES OF NONLINEAR CAPACITANCES

A. S. Berezin, T. S. Kudryashova, L. N. Patrikeyev, and V. D. Popov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Microelectron. 11 Aug. 1966 p 1-5 refs (See N66-34646 20-10) CFSTI: $2.00

Parametrons built with nonlinear capacitances consisting of a varactor, which has a steep volt-capacitance characteristic and a p-n junction with an inverted carrier concentration gradient in the base, are investigated. The volt-capacitance characteristic of this p-n junction is represented by an equation which is expanded to show the condition for parametron excitation. An experimental parametron is diagrammed, and its load characteristic is graphed. A study of the transient process of the rise and fall of parameter oscillations indicated that the rise and fall time did not exceed 10 periods of the fundamental frequency, and it is noted that the parametron is excited in the region where the nonlinear capacitance and the leak resistor are a function of voltage. This allows work to be done with zero bias voltage which considerably simplifies the circuits and lowers power requirements. A.G.O.

N66-34649# Joint Publications Research Service, Washington, D. C.

ON THE TRANSIENT PROCESS OF SWITCHING CONTROLLED p-n-p-n DIODES

V. A. Kuz'min and V. S. Pershenkov *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Microelectron. 11 Aug. 1966 p 10-15 refs (See N66-34646 20-10) CFSTI: $2.00

The current rise time of a duration front when a controlled diode is switched in is calculated for a composite p-n-p transistor having a response time 2 to 3 orders faster than an n-p-n triode. A current rise time theory is proposed that reflects the dependence of the switch-in time on the physical parameters of the device. Experiments of pulse rise time dependence on collector voltage indicated that the modulation by a thick base makes it possible to estimate the shortening of the front when the collector voltage is increased. It was found that the effect of an avalanche on the rise time up to a voltage of the order of 400V is negligible, and the time decreases to fractions of a microsecond when the switching voltage is increased. A.G.O.

N66-34651# Joint Publications Research Service, Washington, D. C.

CALCULATION OF THE VOLTAMPERE CHARACTERISTICS OF THIN-FILM DIELECTRIC TRIODE-ANALOGS

Yu. S. Ryabinkin *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Microelectron. 11 Aug. 1966 p 21-25 refs (See N66-34646 20-10) CFSTI: $2.00

Expressions are derived for the volt-ampere characteristics of thin film dielectric triode analogs in terms of the functions of the physical parameters of their internal structure. A one-dimensional geometry of a thin film triode analog is used in the calculations, and it is pointed out that a necessary condition for the operation of the configuration is a short electron travel time as compared with the Maxwellian relaxation time of the space charge. Development of the various approximations is described, and the mathematical relations such as capacitance of a two-plate condenser per unit area, electron beam potential, and current cutoff condition are shown. A.G.O.

N66-34658# Joint Publications Research Service, Washington, D. C.

SYNTHESIS OF SYMMETRICAL BRIDGE EIGHT-TERMINAL NETWORKS

L. G. Dorfman *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Waveguides 9 Aug. 1966 p 20 (See N66-34655 20-09) CFSTI: $2.00

Abstracted data are presented on a method for synthesizing bridge eight-terminal networks in the form of reciprocal symmetrical circuits without losses. It is reported that the method is used to synthesize a symmetrical bridge eight-terminal network with an arbitrary division factor having a ring structure and consisting of reactive elements with lumped parameters. A.G.O.

N66-34660# Joint Publications Research Service, Washington, D. C.

THEORY OF PLANE SYMMETRICAL TWELVE-TERMINAL NETWORKS

L. G. Dorfman *In its* 22nd All-Union Sci. Session Devoted to Radio Day. Sect. on Waveguides 8 Aug. 1966 p 21 (See N66-34655 20-09) CFSTI: $2.00

Abstracted data are presented from a study on two types of plane symmetrical 12-terminal networks. It is noted that the relationship between the external geometric features of these circuits and the structure of their electrical matrices is established, and that equations are given which relate the elements and the eigenvalues of the electrical matrices. A.G.O.

N66-34671*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
[JOINT SERVICES ELECTRONICS PROGRAM] Semiannual Progress Report No. 71, 1 Jul.–1 Dec. 1965
May 1966 84 p refs Sponsored in part by NASA
(Contracts Nonr-1866(16); Nonr-1866(07); Nonr-1866(28); Nonr-1866(32))
(NASA-CR-77224; AD-634148) CFSTI: HC $3.00/MF $0.75 CSCL 09C

Contents: Very Low Frequency Propagation, Electron and Solid State Physics, Automatic Control, Communications and Networks, Microwave Application of Ferromagnetic and Ferroelectric Materials, and Electromagnetic Radiation.
Author (TAB)

N66-34679*# Texas Univ., Austin. Engineering Mechanics Research Lab.
OPTIMAL STOCHASTIC CONTROL THEORY APPLIED TO INTERPLANETARY GUIDANCE
James Franklin Jordan, Jr. Aug. 1966 246 p refs
(Grant NsG-551)
(NASA-CR-77212; EMRL-TR-1004) CFSTI: HC $6.00/MF $1.50 CSCL 09C

Stochastic systems which contain small continuous additive noise in the controls, as well as small uncertainties in the initial conditions, were studied. A model for the disturbing noise (correlated noise) was developed, and its applicability to the controls of a space vehicle are discussed. The effect of autocorrelated noise on an optimal deterministic trajectory was studied using differential equations which describe the time histories of the means and standard deviations of the state errors resulting from the perturbing noise. These means and standard deviations are computed for the Earth–Mars transfer problem, and results are compared with those obtained for several Monte Carlo simulated trajectories. The problem of finding the optimal stochastic control, conditioned on information about the state of the system during flight, was also analyzed using a method for replacing the mean values of the state components and the Lagrange multipliers. The derived scheme is applied to the interplanetary transfer problem where range-rate observations are taken at discrete instances of time.
S.C.W.

N66-34745# Massachusetts Inst. of Tech., Cambridge.
ON THE MEASUREMENT OF CHARACTERISTIC KERNELS OF A CLASS OF NON-LINEAR SYSTEMS
Richard J. Hooper (Knolls Atomic Power Lab.) and Elias P. Gyftopoulos [1966] 23 p refs Presented at the Symp. on Neutron Noise, Waves, and Pulse Propagation, Gainesville, Fla., 14–16 Feb. 1966
(Contract W-31-109-ENB-52)
(CONF-660206-1) CFSTI: HC $1.00/MF $0.50

The results of some simulated experiments in which the dynamic response characteristics of several nonlinear systems were measured by means of input–output cross correlation techniques are presented. Periodic discrete level input signals were used, and the cross correlation time was taken equal to the period of the test signal.
Author (NSA)

N66-34766# Systems Technology, Inc., Hawthorne, Calif.
COMPILATION AND ANALYSIS OF FLIGHT CONTROL SYSTEM COMMAND INPUTS Final Report, 1 May 1964–30 Apr. 1965
David H. Weir Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1966 92 p refs
(Contract AF 33(615)-1818)
(STI-TR-142-1; AFFDL-TR-65-119; AD-483621)

Flight control command input data are presented for automatic approach and landing, automatic terrain following, and manual control. The data are reduced to analytical forms useful in preliminary design where possible, e.g., servoanalysis methods and approximation techniques appropriate to the use of the data are discussed. Preferred data forms and areas of continuing data need are summarized.
Author (TAB)

N66-34773# RAND Corp., Santa Monica, Calif.
CONTINUOUS CONTROL WITH STOCHASTIC STOPPING TIME
Allen Klinger Jun. 1966 28 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4993-PR; AD-634831) CFSTI: HC $2.00/MF $0.50

The criterion for a continuous control process whose stopping time is a random variable of known cumulative probability distribution is expressed as a single improper integral. (Physical examples of interrupted control situations are: regulator component failure, catalyst deterioration, space vehicle midcourse guidance, and random waiting for a digital computer used in the control of several systems.) A necessary condition for an optimal trajectory is derived, shown to be time-invariant only for the exponential probability law, and related to reliability theory. The optimal feedback control law, optimal trajectory, and minimum expected cost are presented for time-invariant linear systems with quadratic cost and exponentially distributed stopping time. A simple condition on the feedback rule for time-varying linear systems with arbitrary stopping time probability distribution is derived. A connection with the deterministic theory is established via the limit as the variance approaches zero.
Author (TAB)

N66-34776# Institute of Modern Languages, Inc., Washington, D. C.
CONTROL OF THE CURRENT OF A SHORT-CIRCUITED SUPERCONDUCTIVE NETWORK [UPRAVLENIE TOKOM KOROTKOSAMKNUTOYI SVERKHPROVODIASCHEI ZEPI]
V. P. Karzev Ft. Belvoir, Va., Army Engr. Res. and Develop. Labs., Jun. 1966 8 p refs Transl. into ENGLISH from Elektrotechnika (Budapest), no. 1, 1966 p 58–59
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1848-66; TT-66-61534; AD-634516) CFSTI: HC $1.00/MF $0.50

A twelve-pole unipolar static generator with a superconductive shield which permits operation at industrial frequency without a 'spot-delay effect' is discussed.
TAB

N66-34785# Illinois Univ., Urbana. Coordinated Science Lab.
THE ABSOLUTE STABILITY OF SYSTEMS WITH MULTIPLE NONLINEARITIES
Michael S. Davies May 1966 56 p refs
(Contract DA-28-043-AMC-00073(E); Grant AF-AFOSR-931-65)
(R-288; AD-634309) CFSTI: HC $3.00/MF $0.50

Popov's criterion for the absolute stability of nonlinear systems is generalized to include a class of multivariable systems. Both the linear plant and the memoryless nonlinearity are assumed to have several inputs and outputs, continuous time systems and systems involving time lag are treated. An extension to the main stability criterion may be applied when bounds are available on the slopes of the nonlinearity. It is shown that a simplified form of the criterion leads to a passivity condition for an n-port network. Although the stability criterion is in general difficult to apply, it is demonstrated that in some cases the condition may be simplified and still give useful results.
Author

N66-34792*# Mississippi State Univ., State College. Dept. of Electrical Engineering.

DEVELOPMENT OF A VALID MATHEMATICAL FORMULA OR GROUP OF FORMULAS TO ESTABLISH WITHIN AN ACCURACY OF 5% THE INDUCTANCE AUDIO RANGE RESULTING IN BERYLLIUM COIL ASSEMBLIES Final Report

D. D. Wier, B. J. Ball, C. G. Catledge, and L. J. Hill [1961] 129 p refs

(Contract NAS8-20229)

(NASA-CR-77415) CFSTI: HC $4.00/MF $1.00 CSCL 09C

Formulas are derived to determine the net inductance of both a hammer coil and a cryogenic sealing coil; and resistance, capacitance, and inductance determinations are detailed for both types of coils. It is shown that capacitance is not a factor in the equivalent circuits, and that both coils may be represented as having only inductance and resistance at audio frequencies. It is assumed that all dimensions of the coil changed in the same ratio; and, therefore, the derived formulas are all based on the diameter of the coils. In setting up general equations based on change in only one dimension, it was found that current penetration depth of skin effect could not be made a function of this dimension. For the actual coil sizes used, skin effect was found to be negligible for all audio frequencies of the hammer coil, but was a factor to be considered in the upper audio frequencies of the cryogenic sealing coil. Derivations presented were made on the assumption that both coils were in free space. M.W.R.

N66-34793*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

DESIGN GUIDELINES FOR CIRCUITRY IN A NUCLEAR REACTOR-PROPELLED SPACECRAFT Final Report

John L. Westrom 1 Jul. 1966 114 p refs

(Contract NAS8-11755)

(NASA-CR-77419; LMSC/HREC-A782893) CFSTI: HC $4.00/MF $0.75 CSCL 09C

Radiation resistant circuitry and power supplies are considered in a summary of the guidelines and design efforts for circuitry in a nuclear reactor-propelled spacecraft. Mention is made of the testing of building blocks and circuits, a 200-watt power supply utilizing a switching/summing waveform technique, and the regulator operation. Recommendations for future effort in radiation effects deal with topics such as damaging effects on semiconductors, selective sampling, radiation equivalency, variance of device parameters for transistors, and integrated circuitry. Development of a 400 Hz inverter and its computer mechanization are detailed; including the derivation of equations, block diagrams and circuit illustrations, and performance evaluation. A dc to dc converter is discussed, and an analysis of switching regulation includes details of the derivation of the various equations and the parameters for ideal switching frequency. M.W.R.

N66-34826*# National Aeronautics and Space Administration, Washington, D. C.

AUTOMATIC REGULATION AND CONTROL SELECTED PARTS

Ya. Z. Tsypkin, ed. Jul. 1966 465 p refs Transl. into ENGLISH from the Book "Avtomaticheskoye Regulirovaniye i Upravleniye" Moscow, Izd. AN SSSR, 1962 p 1-188; 242-296; 426-473 Presented at the 7th Conf. of Young Scientists of the Inst. of Automation and Remote Control, Mar. 1960

(NASA-TT-F-373) CFSTI: HC $7.00/MF $2.50 CSCL 09C

Conference papers on automatic control, computers, and theory of relay circuits and finite automata are presented. For individual titles see N66-34827-N66-34856.

N66-34827*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECT OF DRY FRICTION AND FREE PLAY ON THE ERROR WITH REVERSAL IN SERVOSYSTEMS

A. I. Andreychikov *In its* Autom. Regulation and Control Jul. 1966 p 1-15 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Investigated were reversal errors of program-controlled machine tool servodrives caused by: dry friction loading, free play in the transmission between the actuator motor and the feedback sensor, and the simultaneous action of free play and dry friction in the system. Reversal errors are analyzed mathematically, error magnitude data recorded, and recommendations for error reduction presented. Simple approximate equations for the error in the reversal region are obtained in several cases, as are computational formulas, without derivation, for dry-friction errors; the initial conditions for certain input actions are presented. An electronic circuit illustration shows correcting feedback circuits as applied to a drive with an amplidyne amplifier. R.Li.

N66-34829*# National Aeronautics and Space Administration, Washington, D. C.

DISSIPATIVITY IN THE LARGE OF A THREE-DIMENSIONAL NONAUTONOMOUS NONLINEAR AUTOMATIC CONTROL SYSTEM

T. G. Babunashvili *In its* Autom. Regulation and Control Jul. 1966 p 32-40 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Conditions for the existence of dissipativity in the large of phase trajectories for a definite class of three-dimensional nonlinear nonautonomous automatic control systems with constant parameters, and its application with time-varying parameters are discussed. The autopilot, as an automatic control system, and its guidance of the rocket at the termination of the launch period is mentioned. In the operation of the system it is necessary to know both the possible maximal deviations of the coordinates, and the time T at the end of which the guidance system can be engaged. A mathematical model representing systems for the equation of motion of a rocket about its lateral axis, and the autopilot elevator channel is presented; inequalities are satisfied to obtain stability of the phase trajectory in the positive direction. A value is determined for T, the time at the end of which the guidance system can be engaged. It is considered that launch safety is ensured by knowledge of the value of R, the maximal deviation of the coordinates; and, of Q, the rocket launch safety region. R.Li.

N66-34830*# National Aeronautics and Space Administration, Washington, D. C.

STUDY OF AN OPTIMAL SYSTEM FOR CONTROL OF FLYING SHEARS FOR A JOBBING MILL

B. B. Buyanov *In its* Autom. Regulation and Control Jul. 1966 p 41-50 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

An experimental electronic circuit was assembled and debugged for the testing of an optimal system for automatic control of the drive of flying shears in a metallurgical plant jobbing mill. The speed of the dc motor (21 kW, 110A, 1500 rpm) was found not to return always to the original speed, since the hysteresis of A and the generator had a strong effect because of the low gain of the speed feedback. Accordingly, a transistorized amplifier was developed to increase the system gain and the accuracy of maintenance of the speed of the shear motor. It was concluded that experimental tests made on the optimal automatic control system satisfied requirements, and that the system provides adequate accuracy of measured

cutoff of the discarded leading ends of rolled metal strips, thereby reducing metal scrap. It is suggested that system accuracy could be improved by increasing the acceleration of the system in the transient process, improving the shape of the current curve, and providing for strict maintenance of the speed during the measured cutoffs. R.Ll.

N66-34831*# National Aeronautics and Space Administration, Washington, D. C.

ANALYZER FOR DISTRIBUTION CURVES OF RANDOM PROCESSES IN THE INFRALOW FREQUENCY REGION

I. N. Bocharov *In its* Autom. Regulation and Control Jul. 1966 p 51–59 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

An instrument for the automatic recording of distribution curves of random electric signals was developed and tested. A functional diagram of the instrument is presented, as well as a block diagram showing the operations that the instrument must perform. Experimental results show that the instrument provides for rapid (1–5 min) recording of distribution curves with a deviation from the theoretical curves of less than 2 percent. Verification of the accuracy was made using sinusoidal distribution curves. In comparison with analytical methods, the adequately high accuracy, and the rapidity of obtaining the distribution curves offer the possibility of operational control of the sources of the studied processes for obtaining distribution curves of a specified shape. R.Ll.

N66-34832*# National Aeronautics and Space Administration, Washington, D. C.

OPTIMAL CONTROL OF SYSTEMS

A. G. Butkovskiy *In its* Autom. Regulation and Control Jul. 1966 p 60–71 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Literature is reviewed on the theory of optimal control of automatic systems. Discussed are: the problem of optimal control for a wide class of linear systems with real characteristics roots and a single control function; the construction of an optimal servosystem consisting of a sequential connection of two motors; optimal processes for linear systems of 2nd, 3rd, and 4th order, with account taken of the barriers imposed on the system coordinates; application of optimal control principle to periodic-operation chemical reactor; control of a chemical reactor for best approximation of its operation to the optimal regime; the method of peak-holding, and the method of introduction of special test signals used in searching for the optimum of a function of a single variable; the creation of noise-resistant optimizers; and the description of a system for the control of the drives of a three-stand, cold-rolling mill. R.Ll.

N66-34833*# National Aeronautics and Space Administration, Washington, D. C.

AUTOMATIC OPTIMIZER FOR THE CONTROL OF CHEMICAL PRODUCTION PROCESSES

B. G. Volik *In its* Autom. Regulation and Control Jul. 1966 p 72–85 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Discussed is the optimization of chemical production processes (i.e., that control which maintains as constant the extremum of some process index such as cost, quantity, or quality of finished product). In the design of the optimizer, experimental and theoretical studies were made of the characteristics of the most common chemical production processes (distillation and certain catalytic processes). Described are: the optimizer structure, pneumoelectric transformers intended for telemetric transmission of signals, the logic device with its storage function, executive devices for variation of the control quantities, control channel switching device, control unit, and the electropneumatic converters. Conclusions indicate that the proposed circuit for an automatic optimizer is noise-resistant and provides for sufficiently precise tracking of the extremum of the quantity being optimized; it permits varying the step magnitude and the operational program over wide limits. It is considered that the circuit for the executive devices can also be used for optimizers with variable, dependent step. R.Ll.

N66-34834*# National Aeronautics and Space Administration, Washington, D. C.

ANALYSIS OF AN EXTREMAL REGULATION SYSTEM WITH PEAK-HOLDING IN THE PRESENCE OF NOISE

V. G. Gradetskiy and Yu. I. Ostrovskiy *In its* Autom. Regulation and Control Jul. 1966 p 86–105 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A proposed analysis technique of an extremal regulation system (ERS) with peak-holding in the presence of noise is presented to establish whether or not a given combination of search speed and search loss can be realized in a system with a low frequency of false switchings. It is pointed out that the analysis technique can be used for the selection of the adjustment of the noise filter, which is one of the possible methods of improving the noise resistance of peak-holding ERS. In the approximate semi-empirical method of analysis discussed, it is assumed that if the frequency of the false switchings is high, a noise filter is introduced into the system. A structural diagram of the system is depicted, and the experimental study of the operation of ERS with the presence of noise was made on an electronic simulator which simulated the entire system including the control. It is considered that results obtained are quite well confirmed by experiment, and the method can be recommended for practical analysis of systems for extremal regulation in the presence of noise. R.Ll.

N66-34835*# National Aeronautics and Space Administration, Washington, D. C.

OPTIMAL EXTREMAL SYSTEMS

N. V. Grishko *In its* Autom. Regulation and Control Jul. 1966 p 106–138 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Optimal extremal control systems with a minimal mean square error of tracking the extremum with random inputs, and their application in the development of a control system for a variable-load, internal combustion engine are discussed. A mathematical formulation of the theoretical study is presented, and diagrams depict: the extremal system, a pneumatic realization of optimal extremal system, a condition diagram of comparison of extremal systems, and a conditional representation of relations among systems from the point of view of their structural properties and dependence of performance criterion K on general structural properties of systems in tracking conditions of medium complexity. Results of the optimal characteristics of the extremal system, determined by variational methods on the basis of the obtained analytic expression for the mean square error K in terms of the specified characteristics of the given controlled system, and the arbitrary characteristics of the chosen extremal system are reported. The resulting optimal characteristics were used in the development of the extremal system described. R.Ll.

N66-34836*# National Aeronautics and Space Administration, Washington, D. C.

AUTOMATIC SELECTION OF INTERPOLATION SEGMENTS FOR A MACHINE TOOL WITH LINEAR INTERPOLATOR

V. V. Karibskiy and A. P. Yevseyeva *In its* Autom. Regulation and Control Jul. 1966 p 139–151 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Two methods are presented for the automatic computation of the motion trajectory for machine tools with digital program control. It was concluded that the approximate method is more universal than the exact method, because for any continuous function $\phi(x)$ the basic program does not change, only the preparatory program for the computation of the function $\phi(x)$ changes. In the remaining particular cases the exact method may be more effective, since it is logically simpler than the approximate method. The use of a universal digital computer for the automation of the process of the preparation of the program for the control of a machine tool is advisable because it accelerates the process of the preparation of the program and reduces the number of possible errors. R.Ll.

N66-34837*# National Aeronautics and Space Administration, Washington, D. C.

SPECIALIZED COMPUTER FOR THE SPECIFICATION OF THE MOTION OF A SYSTEM ALONG A STRAIGHT LINE, PARABOLA AND CIRCLE

V. V. Karibskiy *In its* Autom. Regulation and Control Jul. 1966 p 152–157 ref (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Specialized digital computers (interpolators) and their application in systems for digital program control of milling machines to specify the displacements of the working element are discussed. They are used in cases when it is necessary to provide movement between two reference points along a straight line, parabola or circle. The interpolator described generates control pulses to two-coordinate machine tools in the coordinates X and Y, distributed in time in accordance with the specified interpolation law, where with the transmission of a single pulse there is a displacement of the working element by unit length of the selected scale. A circuit constructed in accordance with the algorithms described for the solution of equations is shown. It consists of two summators of the accumulating type with transmission of the carry unit through the delay line (DL) from the lower place to the higher, a counter register, a counter for readout of the X-coordinates, a control unit and several auxiliary logic elements for the transmission of pulses. R.Ll.

N66-34838*# National Aeronautics and Space Administration, Washington, D. C.

AIRCRAFT LONGITUDINAL STABILITY WITH AN AUTOPILOT HAVING LAG

V. S. Kislyakov *In its* Autom. Regulation and Control Jul. 1966 p 158–169 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A study was made of the longitudinal stability of the short-period motion of an aircraft controlled by an autopilot having time lag. It was found that: (1) The presence of time lag has a significant effect on aircraft stability, manifested primarily in a considerable narrowing of the region of stability of the system as constructed in the plane of the transfer numbers of the autopilot. (2) Neglect of the lag can lead to the instability. (3) The steady-state periodic oscillations which occur on the boundary of the region of asymptotic stability of the considered system are stable in the small, i.e., the boundary is safe in the small. The permissible magnitude of the lag in the autopilot was also determined. R.Ll.

N66-34839*# National Aeronautics and Space Administration, Washington, D. C.

A METHOD OF SYNTHESIS OF CONTROLLED SYSTEMS

A. I. Moroz *In its* Autom. Regulation and Control Jul. 1966 p 170–194 (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Differential equations describing closed control systems are derived, and a method for solution of the posed problem when certain limitations are satisfied is proposed. The problem was to determine the control law ξ for the system such that the imaging point from the initial position M^0 arrives on the sphere of arbitrarily selected radius δ after the specified time t^* and for all $t > t^*$ remains within this sphere. This problem is solved when ρ is a function of ξ selected by the method indicated above and the initial position in the phase space is chosen so that $|\xi_0| \geq \xi_{lim}$; with $|\xi_0| < \xi_{lim}$ the transient process in the closed controlled system damps more rapidly than without the control, but the degree of this damping cannot be made anything desired. If $R^2(\xi, \eta)$ is selected from the functions which vanish not only at the coordinate origin, then by means of the selection ρ = const the degree of damping can be made arbitrarily large. R.Ll.

N66-34840*# National Aeronautics and Space Administration, Washington, D. C.

OPTIMAL CONTROL IN SECOND-ORDER RELAY-PULSE SYSTEMS

V. N. Novosel'tsev *In its* Autom. Regulation and Control Jul. 1966 p 185–194 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

The system for the automatic control of the two-dimensional motion of a material point is described by two finite-difference equations. Reviewed were pulse systems with a set of control actions containing two or three values. It is considered that the use of three values of the control action shortens the time of the optimal transient process for the system considered in comparison with the case of two values. The reduction of the time of the transient process can amount to 0, 1, 2, or 3 steps, depending on the position of the initial point. It is mentioned that further increase of the number of levels used for control does not lead to reduction of the time for the transient process in this simple system, although with an increase of the number of discrete control levels used, greater accuracy of the final result can be obtained. R.Ll.

N66-34841*# National Aeronautics and Space Administration, Washington, D. C.

TRANSMITTER AUTOTUNING SYSTEM USING AN AUTOMATIC OPTIMIZER

K. B. Norkin *In its* Autom. Regulation and Control Jul. 1966 p 195–208 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

The automatic cohtrol of radio transmitters is discussed, and systems for autotuning of the output stage loop, and for automatic loading were developed. A single-channel, noise-resistant, automatic optimizer with proportional action is used, as is antenna coupling regulator (ACR), which is a very simple three-position regulator with a dead zone. Tuning of the transmitter was accomplished by using a circuit containing an antenna coupling controller, and an automatic-optimizer-controlled motor. It was seen that the rate of movement of the optimizer diminished for small input signals. An additional time appears, which it is advisable to use for the separation of the signal from the noise. It follows that noise level at the output of an RC filter is constant in time, and it is rational to use a filter for which the noise level at the output diminishes with time. Additional data is presented on the selection of the optimizer tuning parameters. R.Ll.

N66-34842*# National Aeronautics and Space Administration, Washington, D. C.
BOUNDEDNESS OF TRANSIENT REGIMES IN A PENTAVARIATE AUTOMATIC CONTROL SYSTEM
R. P. Parsheva *In its* Autom. Regulation and Control Jul. 1966 p 209–218 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A pentavariate automatic control system (ACS), equipped with an autopilot having proportional feedback and a three-dimensional field of control with respect to altitude, pitch rate, and deviation of flight altitude from a constant preset value is studied. A controllable winged rocket (with liquid rocket engine and with airspeed stabilizer) is given as an example and equations of motion for the rocket are derived. A determination is made of the form of the roots of the characteristic equation, and the stability of the solution of the homogeneous system of equations is discussed. A general solution of the system is found, and stability according to Lagrange is shown. Defined are: a finite region in which there is embedded every trajectory after passage of a fixed and trajectory-independent starting regime time, and the region which is not left by any trajectory. These two regions permit defining the boundaries of safe launch of rockets and the boundaries of altitude oscillations of winged rockets in horizontal flight. R.Li.

N66-34843*# National Aeronautics and Space Administration, Washington, D. C.
PROGRAM CONTROL SYSTEM WITH REQUENCY SEPARATION OF THE CHANNELS
V. N. Shadrin *In its* Autom. Regulation and Control Jul. 1966 p 219–226 ref (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A system of programmed control of the machining of parts of various configurations on metal-working machine tools and other industrial applications is considered, and a program control system with frequency separation of the channels is considered. Frequency separation, based on the separation of the operational signals by the use of different carriers which are amplitude-modulated by the operational signals, is discussed. It was concluded that higher accuracy could be obtained by reducing the distortions from cross modulation, crosstalk, and by reduction of the error of the rotary transformer and increase of transfer ratio i. As a result of the nonlinear characteristic of the system (magnetic head–tape–magnetic head) noise arises from cross modulation between the channels, which causes additional phase distortions of the signal. According to measurements made, the overall distortions amount to ±8° with use of excitation from the generator of the V tape recorder. Of this about ±4° is due to noise from cross modulation. Therefore, the FM–AM program control system can be recommended for the control of production processes not requiring high accuracy. R.Li.

N66-34844*# National Aeronautics and Space Administration, Washington, D. C.
THREE CHANNEL OPTIMIZER
Ye. A. Fateyeva *In its* Autom. Regulation and Control Jul. 1966 p 227–239 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

An electromechanical optimizer for use in the regulation of the rectification process was developed to search for the minimum with definite relationships of the steam consumption, initial heated mixture, and still product (i.e., that component with the higher boiling point flowing downward). A block diagram of the rectification process control is presented. The quantity being minimized is computed in the computer and delivered in the form of an ac voltage. The optimizer, which uses the gradient principle in searching, has high noise-stability and regulation accuracy because the generation of the operational step is accomplished by integration of the variation of the quantity being minimized, and because an inertial balanced servosystem is used, which increases the limits of the electromechanical integration. Also mentioned are the power supply block, the memory and actuator devices, computer, balanced servosystem, switching unit, and relay block. R.Li.

N66-34845*# National Aeronautics and Space Administration, Washington, D. C.
ANALYSIS OF THE DYNAMIC CHARACTERISTICS OF SYSTEMS FOR THE AUTOMATIC CONTROL OF AIR-CONDITIONING INSTALLATIONS
M. M. Khasanov *In its* Autom. Regulation and Control Jul. 1966 p 240–252 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

An automatic control system (ACS) was developed for a generalized air-conditioning circuit. Among the control parameters developed for use in air conditioning in industrial production areas are those for the temperature and relative humidity of the air. The generalized ACS diagram depicted permits the use of a single static regulator for each regulated parameter with a large number of regulating elements operating sequentially from it. The equations of the controlled system, and of the elements of the ACS generalized diagram were derived in general form. Using as an example a typical installation for air conditioning, the critical regimes of ACS operation were studied, and the performance indices of the system determined. The ACS, which contains two basic control loops (for temperature and relative humidity), combines the operation of its individual elements into a single complex with a minimal number of controllers, and is considered to provide excellent regulation. R.Li.

N66-34846*# National Aeronautics and Space Administration, Washington, D. C.
SIMULATION OF CERTAIN SYSTEMS WITH DISTRIBUTED PARAMETERS
A. G. Butkovskiy *In its* Autom. Regulation and Control Jul. 1966 p 253–266 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A mathematical model was constructed of a system described by two types of partial derivative equations to portray the processes of heating of metal in a through-flow furnace, which is a typical system with spatially distributed parameters, and a method of optimal control simulation is considered. Measurements of the furnace temperature is graphed, and a structural diagram of the system model with distributed parameters shows the drum recording unit, magnetic drum with seven tracks, reproduce unit, controllable functional converter, and aperiodic element. A model of ordinary differential equations approximate the one-dimensional equation of thermal conduction under certain boundary conditions where a thermal conduction coefficient is described. R.Li.

N66-34848*# National Aeronautics and Space Administration, Washington, D. C.
FAST-ACTING ELECTRONIC MULTIPLIERS
F. B. Gul'ko *In its* Autom. Regulation and Control Jul. 1966 p 283–293 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

The fast response time of electronic multipliers used in simulators and electric instrumentation is discussed, and their fundamental criterion of accuracy was tested by two sinusoidal signals. More refined definitions of passband and response

speed are formulated in relation to specific test methods. The electron-beam tube with cylindrical beam is cited as an example of a multiplier whose speed of response is limited primarily by the inertias of the output stage; its dynamic properties were determined with the application of sinusoidal signals to both inputs with the measurement of both dc and ac components at the output. The operation principle of fast-response multipliers using special electron-beam tubes with a parabolic screen is reported. The static error of quadratic functional converters using this tube was found to be no more than 1 percent. The dynamic properties are considered quite high; input capacitance is about 3 pF, output 13 pF. In these multipliers, the passband with application of sinusoidal voltages to both inputs was found to be less than 90 kcps, but was limited primarily by the passband of the resolving amplifiers. R.Ll.

N66-34849*# National Aeronautics and Space Administration, Washington, D. C.

MODELING A CONTROLLABLE DELAY

Zh. A. Novosel'tseva *In its* Autom. Regulation and Control Jul. 1966 p 294–302 ref (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A model is proposed for designing industrial control objects, in which the magnitude of the time delay varies in accordance with some signal, such as in systems containing long pipelines with variable pumping capacity. It is concluded that the control circuit must contain an integrator. As a result of the inconstancy of the period of the staircase curve which is subject to interpolation, the interpolation must be altered, and a multiplier introduced into the circuit. The use of special cathode followers for the signal readout, as well as the use of the method of continuous integration with correction at the end of each cycle for the formation of the output signal is considered to permit reduction of the number of resolving amplifiers in comparison with the analogous circuit for constant delay. Reproduction amplitude error is no more than 3 percent. R.Ll.

N66-34850*# National Aeronautics and Space Administration, Washington, D. C.

ONE TYPE OF FUNCTIONAL CONVERTER WITH SEVERAL INPUTS

M. V. Rybashov *In its* Autom. Regulation and Control Jul. 1966 p 303–314 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A mathematical model is constructed for a nonlinear functional converter of a single variable based on the piecewise-linear approximation of the function being reproduced. A schematic diagram represents a typical circuit with potential-grounded diodes for this class of converter. Equations are derived for all functional relations and certain of their characteristics which can be reproduced with different connections of nonlinearities (in the input circuit, in the feedback circuit, combined connection), and also with differing combinations of parallel connected inputs. A formulation is made for the way a variation of input variable affects the relative error of approximation in the circuit with a nonlinear block. R.Ll.

N66-34851*# National Aeronautics and Space Administration, Washington, D. C.

SOLUTION OF ONE TYPE OF LINEAR ALGEBRAIC EQUATION USING ELECTRONIC MODELS

M. V. Rybashov *In its* Autom. Regulation and Control Jul. 1966 p 315–322 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A model was assembled for a dynamic system with an asymptotically stable rest position, having the property that the coordinates satisfy the original system of the reported algebraic equations. Arbitrary initial conditions were selected, and at the end of the transient process (i.e., in the steady-state condition), the response is recorded. Formulated and solved was a system of algebraic equations in which all functions of time were bounded and continuously differentiable. The asymptotic stability was proved, and the structural circuit of the setup for the formation of a single variable is shown. R.Ll.

N66-34852*# National Aeronautics and Space Administration, Washington, D. C.

SYNTHESIS OF CURRENT-SWITCHING CIRCUITS WITH CELL MATCHING USING p-n-p AND n-p-n TRANSISTORS

T. M. Aleksandridi *In its* Autom. Regulation and Control Jul. 1966 p 323–336 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

A logic circuit, based on the duality operation, is described and used in analyzing circuits with cell matching using semiconductor tridoes of the p-n-p(L_1), and n-p-n(L_2) types. It is pointed out that the purely potential connection between elements leads to the necessity for matching the various input and output circuits. The logical operation, and circuitry of switching elements which realize the p-n-p, and the n-p-n output functions are delineated. Tabular data presented show the dependence of the output function on the input variables for two circuits, and all two-valued switching functions of two variables. From axioms formulated, a series of corollaries (equivalences) is derived which can be used to perform all conversions of the various logic equations in the calculus. From these basic equivalences, other useful relations can be derived to facilitate the tranformations of the equations. Details are included on the technique for the construction of algebraic expressions of logic functions by means of the construction of algebraic expressions of logic functions by means of the normal L-form, and for the canonical expansion for switching functions in terms of logical operations. R.Ll.

N66-34853*# National Aeronautics and Space Administration, Washington, D. C.

OBTAINING PARTICULAR NORMAL FORMS OF BOOLEAN FUNCTIONS WHICH DO NOT GIVE CONFLICTS IN CIRCUIT REALIZATIONS

V. V. Vorzheva *In its* Autom. Regulation and Control Jul. 1966 p 337–345 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

The question of conflicts with the transition from one combination of relay elements to another combination of states, in which there may occur the momentary disappearance of a signal or the appearance of a false signal, is analyzed in order to determine Boolean functions, and structures which are free of conflicts. The output of relay devices, described by the principal normal disjunctive form of the Boolean function, is considered. In the circuit analysis, that form of the Boolean function containing the minimal number of occurrences of the variables (letters) is operative; the circuit realization is presented. An example portrays the particular minimal form obtainted for a Boolean function free from conflict. In view of the duality law, this same method can also be applied for obtaining the conflict-free, minimal forms, starting from the conjunctive normal form of the Boolean function. R.Ll.

N66-34854*# National Aeronautics and Space Administration, Washington, D. C.

METHODS OF MINIMIZATION AND CONSTRUCTION OF BRIDGE STRUCTURES FOR RELAY DEVICES

V. P. Didenko *In its* Autom. Regulation and Control Jul. 1966 p 346–367 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

Previous studies on the minimization of Boolean functions, and the construction of minimal forms are reviewed; outlined is a method of constructing bridge structures of relay contact devices which takes account of the alternate paths as primary paths to shorten the sorting used in the second stage in the construction of minimal forms. The determination, selection, and number of prime implicants (consisting of variables corresponding to the essential numbers of sets and only of them) in the minimal form is investigated. The entire minimization process is represented in tabular form. R.Ll.

N66-34855*# National Aeronautics and Space Administration, Washington, D. C.

REALIZATION OF BOOLEAN FUNCTIONS AND VARIABLES ON CONTACTLESS LOGIC SWITCHES BY THE METHOD OF REDEFINITION

V. D. Kazakov and V. V. Naumchenko *In its* Auto. Regulation and Control Jul. 1966 p 368–375 (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

In connection with computer technology and the development of complex devices of digital automation and remote control, the realization of Boolean functions switching circuits s investigated. By redefining (e.g., to symmetric functions, or to functions of the same class as the symmetric functions) such functions, they can be brought to a convenient form. It is indicated that the realization of the symmetrical functions on contactless models of abstract neurons gives the possibility of realizing complex functions using a very small number of switching elements. A representation of a given state table by a complex symmetrical function is presented, and a method of reduction of the state table to a form convenient for realization is described. It is considered that this approach for minimization of relay structures (in which by means of the unused states the table is expressed in terms of some ordered function) can be useful in the synthesis of various sorts of decoders, distributors, and counter cells. R.Ll.

N66-34856*# National Aeronautics and Space Administration, Washington, D. C.

MINIMAL FORMS OF SYMMETRICAL BOOLEAN FUNCTIONS OF ANY NUMBER OF VARIABLES

Y. D. Kazakov *In its* Autom. Regulation and Control Jul. 1966 p 376–383 (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

For use in the synthesis of relay systems, a method is presented for directly obtaining the minimal normal forms (i.e., sp: sum of products, or ps: product of sums) of symmetrical Boolean functions which are given in canonical representation. Considered is a method of finding the sp-minimal form of Boolean functions given in the canonical sp-form. A theorem on the sum of products of the Boolean function is proven on the basis of the correspondence between the Boolean and logical functions, and a combinatorial problem stated is solved for a corollary to determine the number of minimal forms of a single function. R.Ll.

N66-34882# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OPTIMIZATION OF A THRESHOLD LEVEL VALUE OF A COMPUTING DEVICE

A. M. Bonch-Bruyevich 21 Jan. 1966 12 p refs Transl. into ENGLISH from Avtomatyka (Kiev), no. 5, 1964 p 31–35 (FTD-TT-65-1485; TT-66-61417; AD-633815) CFSTI: HC $1.00/MF $0.50

The author considers the question of ensuring a minimum of complete probability of the error of correct detection during receiving of a signal distorted by noise with the aid of a threshold computing device with a regulated threshold level. This problem may be solved on using either a hunting extremal regulator or a regulator with feedback. The two regulators are compared from the standpoint of noiseproof properties. The paper also gives extremal dependences of the performance indicator of the receiving device, from which it follows that with various relations of signal to noise the dependences not only shift but even change their shape. This is a feature of the computing device as a controlled member. Author (TAB)

N66-34909# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE DESIGN OF ONE CLASS OF SERVO SYSTEMS CLOSE TO THE OPTIMAL

A. A. Vavilov and F. F. Kotchenko 13 Jan. 1966 23 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Elektromekhan. (Novocherkassk), no. 8, 1963 p 961–972 (FTD-MT-64-305; AD-635272) CFSTI: HC $1.50/MF $0.50

In servo systems with a small zone of linearity it is possible to realize operating conditions close to the optimum, during maximum signal at input of system and with limitations of voltage in the motor, by fulfilling certain relationships between parameters of the system. Results of an automatic compensator EPP-09 indicate that the necessary relationships between parameters in such systems may be comparatively simply realized in practice. Author (TAB)

N66-34928*# Brown Univ., Providence, R. I.

DISCONTINUOUS VECTOR FIELDS AND FEEDBACK CONTROL

H. Hermes *In* NASA. Marshall Space Flight Center Proc. of the 24th Seminar on Space Flight and Guidance Theory 23 Jun. 1966 p 25–41 refs (See N66-34926 20-30) CFSTI: HC $3.00/MF $1.00

(Grants NGR-40-002-015; AF-AFOSR-693-65)

It is shown that control laws synthesized from open loop controls may lead to vector fields which are not stable with respect to measurement; and an example is given for which optimal feedback control exists when solutions are taken in the classical sense, but does not exist if solutions are taken according to the definition of Filippov (an absolutely continuous vector valued function). The main result shows that if a vector field is stable with respect to measurement, then the classical solution is also a Filippov solution. If the vector field is stable, solutions of the initial value problem for the corresponding differential problem equation are unique if (time) $t \geq 0$; and such a solution when evaluated at a fixed positive time varies continuously with the initial data. As time increases, solutions may join but not branch; and, therefore, feedback controls which are meaningful from an applications viewpoint should lead to stable vector fields. M.W.R.

N66-34929*# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Systems Research.

ESTIMATION OF THE DOMAIN OF ATTRACTION

Gunther R. Geiss *In* NASA. Marshall Space Flight Center Proc. of the 24th Seminar on Space Flight and Guidance Theory 23 Jun. 1966 p 43–75 refs (See N66-34926 20-30) CFSTI: HC $3.00/MF $1.00

(RM-316J)

A survey of various approaches to the problem of estimating the domain of attraction of an equilibrium solution to a system of nonlinear autonomous differential equations is given. Based upon observations resulting from this survey the problem is reformulated as that of optimally choosing the Liapunov function from the space of positive definite quadratic forms. An estimate of the domain of attraction is then obtained

as the solution of a minimization problem. This approach to the problem has the advantages of (1) being designed specifically for machine computation, (2) yielding an estimate that is readily visualized, and (3) being relatively insensitive to system dimension. Some preliminary numerical results are presented for the Duffing equation with damping. Author

N66-35014*# California Univ., Berkeley. Electronics Research Lab.
SEMIANNUAL PROGRESS REPORT NO. 1, 16 NOVEMBER 1964-30 JUNE 1965
[1965] 304 p refs
(Grant NsG-354; Contracts AF 33(615)-2306; AT(11-1)-34; Nonr-222(57); Grant NSF GP-2413 et al)
(NASA-CR-77391) CFSTI: HC $7.00/MF $1.75 CSCL 09C

Summary reports are given of various research projects in the fields of bioelectronics, electron streams and interactions, plasmas, quantum and optical electronics, radiation and propagation, solid-state electronics, and systems. Publications, including technical reports and memoranda, technical talks, and published papers, are listed. L.E.W.

N66-35029# Services Electronics Research Lab., Baldock (England).
S.E.R.L. TECHNICAL JOURNAL, VOLUME 16, NO. 1
L. N. Large et al Jul. 1966 31 p refs
CFSTI: HC $2.00/MF $0.50

Ion implantation, machining by laser beam, and Gunn diodes are covered in four papers dealing with microelectronics. The doping of semiconductors by ion bombardment is considered in a paper on junction formation in germanium with Sb^+; and major advantages of the method used are ionic penetration achieved and ability to control the size and position of the treated area. The laser beam machining method makes use of a pulsed high pressure helium–neon laser. Oscillations covering four to 31 Gc/s from a single Gunn diode, which is a solid state microwave generator, are discussed; as is the resonant circuit operation of Gunn diodes. It is shown that the key to understanding the resonant circuit behavior in a Gunn diode lies in the impedance presented at the second harmonic of oscillation. This permits consideration of the device as a self-pumped parametric oscillator, and the subsequent development of useful microwave circuits with an octave continuous tuning range. M.W.R.

N66-35049*# Rensselaer Polytechnic Inst., Troy, N. Y.
IDENTIFICATION AND CONTROL OF A FLEXIBLE LAUNCH VEHICLE
Rob Roy and K. W. Jenkins Washington, NASA, Aug. 1966 159 p refs
(Grant NGR-33-018-14)
(NASA-CR-551) CFSTI: HC $5.00/MF $1.00 CSCL 09C

The problem of controlling a system described by a set of difference equations when some of the system parameters vary from their nominal value is analyzed. The system has both statistical and deterministic disturbances acting upon it. A control is to be synthesized which regulates the state of the system in an optimal fashion, as defined by a quadratic performance index, using only the available noisy measurements. The control system is arbitrarily chosen to comprise a control loop and a parameter identifier. The identifier estimates the unknown plant parameters from normal observations of the plant input and output. The control loop alters its policy in accordance with these new parameter values. The control loop is obtained from a Dynamic Programming derivative which accounts for the deterministic as well as the statistical disturbances. The resulting system is comprised of a least squares state estimator, a feedback gain matrix operating on this estimate and a feedforward input term. Author

N66-35196# Weapons Research Establishment, Salisbury (Australia). Dept. of Supply
A NUMERICAL SOLUTION OF THE TRANSMISSION LINE PARAMETERS OF UNIFORM T.E.M. TRANSMISSION LINES WITH CURVED BOUNDARIES
C. T. Carson Jun. 1966 14 p refs
(WRE-TN-PAD-122) CFSTI: HC $1.00/MF $0.50

A finite difference solution was modified to permit curved boundaries, and a net was used to obtain the odd mode transmission line parameters. Boundaries were specified by scanning all the nodes of the net and suitably tagging each irregular node. The characteristic impedance of coaxial line, and the even and odd mode characteristic impedances of the coupled rods were obtained and are illustrated. N.E.N.

N66-35303# United Kingdom Atomic Energy Authority, Harwell (England). Engineering Div.
ELEMENTARY MATHEMATICAL LOGIC AND SOME APPLICATIONS TO ELECTRONICS
P. A. Newson May 1966 230 p refs
(AERE-R-4937) CFSTI: HC $3.75/MF $1.50

The fundamental principles of Mathematical Logic are presented and explained, and their realisation in terms of transistor and relay circuits discussed. The various manipulations to which binary-type quantities may be subjected (Encoding and Decoding, Scaling, Arithmetical operations, Comparison, Memory, Storage, etc.) are discussed from the viewpoint of the insight which the logical principles give into the problems, with the object of showing how much insight is obtainable from the very elementary theory. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-34122# Ohio River Div. Labs., Cincinnati.
BASIS FOR RIGID PAVEMENT DESIGN FOR MILITARY AIRFIELDS
R. L. Hutchinson May 1966 77 p refs *Its* Misc. Paper no. 5-7
(AD-634l4) CFSTI: HC $3.00/MF $0.75

The paper was organized to present the various factors which influence the current design criteria with a brief explanation of how the numerical values of each was derived. Author (TAB)

N66-34227# California Univ., Berkeley. Coll. of Engineering.
EXPERIMENTAL INVESTIGATION OF THE INITIATION OF DETONATION BEHIND A REFLECTED SHOCK WAVE
Thomas J. Krusic Jan. 1966 39 p refs *Its* Tech. Note No. 1
(Grant AF-AFOSR-129-66)
(AFOSR-66-0940; AS-66-2; AD-634288) CFSTI: HC $2.00/MF $0.50

The purpose of this work was to develop an experimental apparatus for the study of the initiation of detonation in a gaseous medium as a result of shock compression. The design of the apparatus is described, and results of some preliminary experiments are reported. They indicate that the mechanism of the initiation process behind reflected waves in a shock tube is essentially different than that caused by an accelerating flame. Author (TAB)

N66-34237# Illinois Univ., Urbana. Noyes Chemical Lab.
ELECTRON GUN PERFORMANCE USING A MODIFIED APPEARANCE POTENTIAL TECHNIQUE Research Report No. 4
G. Sanzone Apr. 1966 13 p refs submitted for publication
(Grant AF-AFOSR-588-64)
(AFOSR-66-0955; AD-634430) CFSTI: HC $1.00/MF $0.50

A modified retarding potential difference technique was applied to the electron gun of a time-of-flight mass spectrometer. Performance of the electron gun is described and the controls used are presented schematically. A method is suggested for testing precision of appearance and ionization potential measurements. Author (TAB)

N66-34281# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LAUNCHING OF GUIDED ROCKETS
M. V. Patrikeytsev 19 Jan. 1966 90 p refs Transl. into ENGLISH of the book "Pusk Upravlyayemykh Raket" Moscow, Voyennoye Izd. Min. Oborony SSSR, 1963 p 1-83
(FTD-MT-64-528; AD-633660) CFSTI: HC $3.00/MF $0.75

In the pamphlet and arrangement and action of ground equipment of rocket complex, different auxiliary equipment ensuring launching of rockets, and the role and problem of systems of flight control are explained. The pamphlet tells about preparation of rockets for launching and its accomplishment from ground, naval, and aircraft launchers. All the actual and numerical material placed in the pamphlet is taken from open Soviet and foreign press, and questions of prospects of development of ground equipment are presented with respect to the views of foreign military specialists. The pamphlet is designed for soldiers, sergeants, students of military schools, and also for a wide circle of readers interested in rocket technology. Author (TAB)

N66-34423# Martin Co., Denver, Colo.
THE MARTIN COMPANY'S LOW-G EXPERIMENT FACILITY
H. L. Paynter *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer under Low Gravity [1965] 17 p refs (See N66-34406 20-12) CFSTI: HC $7.70/MF $2.25

The Martin Company 75-ft drop test facility is described. This facility provides repeatable and controllable low-g conditions of 10^{-4} to 10^{-2} g for 2.1 sec. The test cell falls inside an evacuated drag shield while being accelerated at constant g-levels. Both indirect and planar lighting techniques are used for 16-mm photographic documentation of test results. Author

N66-34672*# Space Technology Labs., Inc., Redondo Beach, Calif.
A SINGLE-AXIS SPACE SIMULATOR FOR TESTING THE OGO ALTITUDE CONTROL SYSTEM
N. H. Beachley Jul. 1963 42 p refs
(NASA-CR-77223; STL-2313-6007-KU-000) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Design details are given on the single axis simulator which consists of a plywood disk supported from the ceiling by a 9 ft cable, and a servo system capable of rotating the top cable support to match the angular position of the plywood disk. The requirements for the support cable are defined, and the necessary controls for adjusting the external torque applied to the platform are considered. Equations are formulated for establishing criteria for the suspension cable, and the cable support servo; and for calculating the side sway of the platform. Calibration procedures are described, and the required equipment listed. The Orbiting Geophysical Observatory (OGO) attitude control system is discussed in relation to testing techniques. Test methods are detailed for the noon turn, the eclipse turn, and the limit cycle. A figure is included to depict the typical curve of control system performance during a post-eclipse turn. M.G.J.

N66-34742# European Organization Nuclear Research, Geneva (Switzerland).
A SONIC SPARK CHAMBER SYSTEM
G. Bellettini, G. Cocconi, A. N. Diddens, R. Donnet, M. Ferrat et al 25 Oct. 1965 66 p refs
(CERN-65-33)

A sonic spark-chamber system used for measurements of proton scattering, in the angular region of 2 to 20 mrad and at energies around 20 BeV at the CERN Proton Synchrotron, is described. Up to 12 events per machine cycle can be recorded, the relevant parameters of each event being written on magnetic tape after having been checked by a small computer on-line. All subsequent calculations were done on a large computer off-line. Author (NSA)

N66-34746# Oak Ridge National Lab., Tenn.
STEAM CONDENSATE BETA-GAMMA MONITOR AT THE FISSION PRODUCTS DEVELOPMENT LABORATORY, BLDG. 3517
L. H. Chase and D. J. Knowles 17 Feb. 1966 6 p
(Contract W-7405-ENG-26)
(ORNL-TM-1442) CFSTI: HC $1.00/MF $0.50

Steam condensate from the Fission Products Development Laboratory is stored in a 2000-gal underground tank, and monitored continuously for beta-gamma radiation, and at intervals is drained into the ORNL Process Waste System. The pumping system for withdrawing samples and the associated radiation monitoring system are described, and a checkout procedure is included. Author (NSA)

N66-34748# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
Y-12 CLEAN ROOM FACILITIES
J. C. Little 14 Mar. 1966 31 p
(Contract W-7405-ENG-26)
(Y-EA-49) CFSTI: HC $2.00/MF $0.50

Clean room facilities at the Y-12 plant are described, along with testing methods used to determine contamination. The two methods primarily used to control contamination are the absolute filter and the laminar flow concept of air distribution. Environmental conditions at Y-12 are also discussed. NSA

N66-34803*# Planning Research Corp., Los Angeles, Calif.
AN AIRBORNE EVALUATING EQUIPMENT STUDY Quarterly Progress Report, 9 May-8 Aug. 1966
12 Aug. 1966 10 p
(Contract NAS8-20367)
(NASA-CR-77337; PRC-D-1303) CFSTI: HC $1.00/MF $0.50 CSCL 22D

Systems implications, alternate hardware approaches, software, and test information flow are discussed in terms of a study of airborne evaluating equipment (AEE). Primary effort

was devoted to the use of the AEE concept in the Apollo applications program (AAP); and results indicated that such a concept could be implemented, but with considerable cost due to changes in ground system software and operational procedures. It is noted that if AAP vehicles had the AEE and Apollo vehicles did not, the complexity of ground operations would be severely increased. M.W.R.

N66-34806# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.

A FIELD DETECTOR STATION FOR THE DASA FALLOUT AND TRANSIT DOSE RATE MEASUREMENT SYSTEM, 21 JANUARY-1 MARCH 1966

Donald A. Paynter Edgewood Arsenal, Md., Nuc. Defense Lab., Aug. 1966 48 p

(Contract DA-49-146-XZ-292)

(NDL-TR-71, Suppl.; DASA-1688, Suppl.; AD-636206) CFSTI: HC $2.00/MF $0.50

This report describes a solid-state version of the detector station electronics used in the DASA fallout and transit dose rate measurement system. The basis report, dated Dec. 1965, describes the measurement system. The performance of the solid-state version equals or exceeds that of the experimental vacuum tube model it replaces, and it reflects both cost and electrical economies. A by-product of the design is the availability of a frequency modulated ac output signal that can be readily transmitted, recorded, and digitized without intermediate signal processors as would be required with dc data signals. The system's resulting economies are outlined.

Author (TAB)

N66-34961# Bell Helicopter Co., Fort Worth, Tex.

CONTACT ANALOG SIMULATOR EVALUATIONS: UNUSUAL ATTITUDE MANEUVERS

Carl A. Koch and Dora J. Dougherty Dec. 1965 33 p refs

(Contract Nonr-1670(00))

(D228-421-504; AD-634985) CFSTI: HC $2.00/MF $0.50

The study was performed to determine the pilot's ability to recover from unusual attitude and to handle emergency maneuvers using the contact analog display. Five recoveries from unusual attitudes and two autorotation maneuvers were investigated. Four subjects performed each maneuver under two experimental conditions. Two display conditions were tested to determine the pilot's ability to reorient himself following the maneuver. One display condition employed the contact analog with the pathway and the other display condition employed same without the pathway. Performance measures included heading, pitch, yaw and impact G. Analysis of the findings indicates that (1) the pictorial qualities of the contact analog permit easy and positive recovery from unusual and emergency maneuvers; (2) the pathway had no significant effect on the pilot's ability to recover; (3) the pathway permitted reorientation with the original flight path; and (4) any disorientation effects of unusual maneuvers with respect to attitudes seem to be eliminated with the contact analog display.

Author (TAB)

N66-35037# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Gasdynamik.

THE QUALITIES OF THE TEST-SECTION OF THE TRANSONIC WIND-TUNNEL OF THE AVA [DIE STRAHLEIGENSCHAFTEN DER MESSTRECKE DES TRANSSONISCHEN WINDKANALS DER AVA]

W. Lorenz-Meyer Apr. 1966 47 p refs In GERMAN; ENGLISH summary

(DLR-FB-66-19; AVA-FB-66-04) CFSTI: HC $2.00/MF $0.50

The quality and usefulness of a wind-tunnel depend essentially on the properties of the stream in the test-section. In order to become acquainted with the stream of the new transonic wind-tunnel (1m×1m) of the Aerodynamische Versuchsanstalt Göttingen, with a Mach number range from Ma=0.4 to Ma=2.25, measurements of pressure distributions are carried out in five horizontal sections of the transonic test-section and in the two fixed nozzles (Ma=1.5 and Ma=2.0). With certain adjustments of the tunnel parameters the Mach number in the model range alters within ±1%. For testing the shock-wave extinction by the perforated test-section walls, pressure distributions on a surface line of a 20°-cone-cylinder-model with 1% blockage are measured with Mach numbers ranging from Ma=0.8 to Ma=1.15. It can be shown that the canceling properties of the test-section walls of the transonic wind-tunnel of the AVA are in good agreement with other wind-tunnels which have similar test-section walls. Author

N66-35072# Ballistic Research Labs., Aberdeen Proving Ground, Md.

FLOW CHARACTERISTICS OF THE BALLISTIC RESEARCH LABORATORIES SUPERSONIC WIND TUNNEL NO. 1

Clarence C. Bush Feb. 1966 52 p refs

(BRL-MR-1731; AD-635156) CFSTI: HC $6.00/MF $0.50

The Ballistic Research Laboratories' Supersonic Wind Tunnel No. 1 flow characteristics are presented in detail to assist those who may wish to make use of the facility. Techniques and instrumentation used in calibrating supersonic nozzles for Mach number and flow direction distributions are discussed, as well as nozzle adjustment procedures used to improve the flow in the testing region for nozzles with flexible walls. Author (TAB)

N66-35093# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

A LOW PRESSURE CHAMBER FOR ESTIMATION OF THE GAS EXCHANGE RATIO

George H. Kydd and Kenneth H. Dickerson 30 Dec. 1965 37 p refs

(NADC-MR-6513; AD-631400) CFSTI: HC $3.60/MF $0.50

An experimental system for exposing small laboratory animals to specified gas mixtures is described. System pressure may be set at levels up to atmospheric. A demand regulator is used to add oxygen to a pre-set pressure level, in proportion to the amount of carbon dioxide removed. Flowmeters and gas analyzers are provided for obtaining the oxygen flow rate into and the carbon dioxide removed from the system. Data from these instruments are read out as often as once a minute and are punched into IBM cards which are processed in a computer. The system is designed for experiments that last for several days or weeks. Author (TAB)

N66-35143# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut für Physik.

APPARATUS FOR TRANSMITTING MOTION IN A VACUUM SYSTEM [VORRICHTUNG ZUR BEWEGUNGSUEBERTRAGUNG IN EIN VAKUUMSYSTEM]

F. W. Edl 1966 10 p In GERMAN Submitted for Publication

(SGAE-PH-41/1966) CFSTI: HC $1.00/MF $0.50

Described is the construction of an apperatus that combines the flexibility of its various structural members to transmit six different motions into a vacuum system. This mechanical structure can induce horizontal, vertical, and longitudinal movements, shaft rotations, as well as rotations around the vertical and horizontal axes of objects placed in vacuum chambers. Transl. by G.G.

N66-35150# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Flight Dynamics Lab.
DESIGN AND PERFORMANCE OF A 15 KW WIDE BAND ACOUSTIC FACILITY Final Technical Report, Nov. 1960–Jun. 1964
Keith M. Hankel and John P. Henderson Mar. 1966 63 p refs (AFFDL-TR-66-8; AD-634904) CFSTI: HC $3.00/MF $0.75

Details of the design and performance of a wide band, high intensity, acoustic test facility are presented. The wide band siren, horn network, sound isolation room, noise measurement and analysis instrumentation, input power requirements, and measured performance characteristics of the facility are described. The problem of the presence of several discrete frequency peaks in the spectrum of the original siren configuration is discussed along with techniques which were investigated to improve the spectrum. Frequency modulation of the rotor speeds is shown to result in a relatively smooth, continuous random spectrum. The limited spectrum shaping capabilities of the siren are discussed. Recommendations are made for improvements that could be incorporated into future design of sirens of this type. (TAB)

N66-35155# Air Force Academy, Colo. Frank J. Seiler Research Lab.
DESIGN, CONSTRUCTION, AND CALIBRATION OF THE FJSRL 17 IN LOW DENSITY SHOCK TUBE Final Scientific Report
Charles F. Stebbins and Douglas S. Johnson May 1966 46 p refs
(SRL-66-0006; AD-635305) CFSTI: HC $2.00/MF $0.50

The tube is to be used for studying real gas phenomena in a real shock tube. The FJSRL shock tube can be fired at test pressures ranging from 1/2 micron Hg up to atmospheric pressure, with multi-test and multi-driver gas capabilities. Diaphragm pressure ratios range between 100,000 and 10^8 giving a practical range of Mach numbers, in argon, of $2 < M_s < 10$. The Mach number repeatability of the tube is to within approximately 0.5%. The shock wave was shown to decelerate only 0.1%/ft near the test section endwall for the full tube operating range, guaranteeing an essentially constant Mach number over models or instruments of reasonable length. The tube has excellent integrity as a vacuum vessel with a leak rate of < .01 micron/hour. Author (TAB)

N66-35266*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSIF: WOOMERA
[1965] 30 p
(Contract NAS7-100)
(NASA-CR-77601; JPL-TM-33-223) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Details are given on the facilities and functions of the various major elements of the Deep Space Network (DSN), which was specifically designed to communicate with space probes traveling to the moon and beyond. The main elements of the DSN are listed as the Deep Space Instrumentation Facility (DSIF), the Space Flight Operations Facility (SFOF), and the ground communication system which connects all parts of the DSN by telephone and radio-teletype. A map shows the location of the DSIF stations which circle the globe at intevals of 120° longitude in order to maintain continuous coverage of the spacecraft. The basic DSIF tracking antenna used at all stations is described, along with the Cassegrainian feed system which is the focal point for receiving and sending signals. Data acquisition and processing procedures are summarized. Information pertaining to the construction, operation, and maintenance of the particular station is included. M.G.J.

N66-35267*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSIF: JOHANNESBURG
[1965] 31 p For abstract see N66-35266 20-11
(Contract NAS7-100)
(NASA-CR-77600; JPL-TM-33-224) CFSTI: HC $2.00/MF $0.50 CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-34141# Springfield Armory, Mass.
ACOUSTICAL AND VISUAL ATTENUATION THROUGH DYNAMIC REGULATION OF MUZZLE GAS FLOW
Wayne H. Watling Jun. 1966 15 p refs Presented at Army Sci. Conf., West Point, N. Y., 14–17 Jun. 1966
(AD-634649) CFSTI: HC $1.00/MF $0.50

This paper presents the fundamental concepts of fluid flow on which to base theoretical and empirical studies in the use of weapon muzzle attachments used for flash and sound suppression. It presents the development of an improved flash suppressor for a given weapon and provides a chapter of experimental data to be added to the theoretical data published in the references. When research was initiated on this project, the paucity of published test data left the researcher with something to be desired, that is, the link between theory and reality. The paper further serves to illustrate the fact that here is a fertile field for future research in the field of fluid dynamics. As in most problem solutions, the most coveries continue along the theory of submerged jet flow, heat transfer, thermodynamic properties of propellants, and equations of state of gun gases, the many assumptions now being made during theoretical analysis will be replaced with fact and area of transitional ballistics will become thoroughly defined. This will reduce the art of muzzle device development to a practical engineering science. Author (TAB)

N66-34142# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology.
JOURNAL OF APPLIED MECHANICS AND TECHNICAL PHYSICS (PMTF) (Selected Articles)
31 Jan. 1966 41 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 1, Jan.–Feb. 1965 p 45-56; 88-92
(FTD-MT-65-538; TT-66-61272; AD-633118) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. DETERMINATION OF HEAT FLOW IN THE ENVIRONMENT OF A CRITICAL POINT OF DOUBLE CURVATURE DURING THE FLOWING AROUND OF A BODY BY A DISSOCIATING GAS OF ARBITRARY CHEMICAL COMPOSITION G. A. Tirskiy p 1–22 refs (See N66-34143 20-33)
2. REACTIVE IMPULSE AT LARGE SPEEDS OF IMPACT E. I. Andriankin p 23–35 refs (See N66-34144 20-12)

N66-34144# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REACTIVE IMPULSE AT LARGE SPEEDS OF IMPACT

E. I. Andriankin *In its* J. of Appl Mech. and Tech. Phys. 31 Jan. 1966 p 23–35 refs (See N66-34142 20-12) CFSTI: HC $2.00/MF $0.50

Consideration is given to the phenomenon appearing during the interaction of a meteorite with a solid barrier impacting at high velocity and in a vacuum. The derivation is obtained from the laws of conservation on the front of a strong shock wave. The heat capacity of a unit mass of the gas and the ratio of heat capacities are considered constant. C.T.C.

N66-34146# Houston Univ., Tex. Dept. of Mechanical Engineering.

SCALING FACTORS FOR USE WITH RIPPLE TANK STUDIES OF WAVE PROPAGATION IN A FLUID VOLUME

William S. Mitchell and Douglas F. Muster Aug. 1965 39 p refs

(Contract Nonr-4492(01))

(TR-1; AD-633675) CFSTI: HC $2.00/MF $0.50

A study is made of wave propagation on the surface of a liquid in a ripple tank. The waves under study are of the deep-water capillary type (that is, short wave length); their velocity and mode of propagation are influenced by two independent parameters; surface tension and the generated frequency. Since the velocity of wave propagated in a fluid volume is independent of frequency and that of surface waves is not, corrective scaling factors are derived to account for this difference, that is, an expression is developed which correlates the velocity of a wave propagated in a fluid volume with the velocity of a two-dimensional wave on the surface of a fluid, by using properly sized and positioned reflecting boundary surfaces which protude through the air-liquid interface in the ripple tank. It is possible to study the behaivor of sound waves in a fluid volume with prototype reflecting boundary surfaces. A description (including photographs) of the construction details of the particular ripple tank used in the study is given. Author (TAB)

N66-34153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDYING THE MOVEMENT OF A LIQUID IN A JET TUBE

L. M. Trifonov 17 Mar. 1966 18 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Moscow). No. 233, 1964 p 77–84

(FTD-TT-65-1407/1+2+4; TT-66-61413; AD-633699) CFSTI: HC $1.00/MF $0.50

The appearance of vibrations in a jet tube in association with an increase in the pressure of the working liquid used in hydraulic systems is discussed. The nature of these vibrations and their effects of liquid flow is examined in terms of the flow resistance force and the flow velocity. D.T.

N66-34171# Harry Diamond Labs., Washington, D. C.

USE OF IONIZATION AND THIN-FILM PROBES TO LOCATE SHOCK FRONTS IN A PRESSURE-DRIVEN SHOCK TUBE

Harry A. Gieske Apr. 1966 24 p refs

(HDL-TR-1321; AD-634509) CFSTI: HC $1.00/MF $0.50

The usefulness of ionization probes and thin-film probes for locating shock fronts in air and in argon was determined for the test conditions of $8 < Ms < 11$ and $2 < P_1 < 20$ mm hg, where Ms is the shock Mach number and P_1 is the initial pressure in the shock tube, with the probes located in the field of view of a Kerr cell shuttered shodowgraph. The shock front-to-probe distance was correlated with the probe output by displaying the Kerr cell shuttered pulse and the probe signal on the same oscilloscope trace. The results show that the thin-film probe is superior to the ion probe for locating the shock front. There being a small variation in signal delay time of approximately 0.2 microsec for the thin film while the ion probe delay time varied from 0.2 to 3.0 microsec, depending upon test conditions and test gas. Author (TAB)

N66-34200# Aeronutronic, Newport Beach, Calif.

SHOCK–SHOCK INTERACTION THEORY INCLUDING REAL GAS AND THREE DIMENSIONAL EFFECTS Final Report

Thomas D. Taylor Apr. 1966 75 p refs

(Contract DA-28-017-AMC-1989(A))

(PA-TR-3319; AMC-66-3; AD-634600) CFSTI: HC $3.00/MF $0.75

The report presents a numerical technique which can be employed to study the interaction of two nearly planar shock waves. The technique is applied to the head-on interaction of a blast wave and a bow shock of a reentry vehicle. The application is limited to the axis of symmetry of the flow field. Real gas effects are included by allowing γ (the adiabatic gas constant) to vary across flow discontinuities. The values of γ are determined from curve fits to Gilmore's tables. Three dimensional effects are incorporated in the study by using reentry flow field calculations to obtain velocity gradients and flow conditions behind the reentry bow shock. A computer program for the IBM 7090-94 which was developed to perform the shock–shock interaction study is given Author (TAB)

N66-34262# Rochester Univ., N. Y. Acoustical Physics Lab.

DYNAMICS OF A TRANSLATING CAVITY IN A LIQUID

Anthony Eller 31 May 1966 173 p refs

(Contract Nonr-668(18))

(AD-634743) CFSTI: HC $5.00/MF $1.00

A strong sound field in a liquid may generate small cavities that move rapidly through the liquid. The study is an analysis of the dynamics of a cavity in translational motion. A principal conclusion is that translating cavities have a stable size and shape for a wide range of conditions. It is also found that the presence of translational motion contributes an outward dynamic pressure that tends to enlarge the cavity. As a result, the equilibrium radius of a translating cavity is greater than the equilibrium radius of the same cavity at rest. The analysis is divided into two parts. The first part is a study of the equilibrium size and shape, stability, and modes of oscillation of a translating cavity in an infinite, incompressible, and inviscid liquid. In the second part an approximate model without the complexities due to the time dependence of the cavity shape. Author (TAB)

N66-34275# Colorado State Univ., Fort Collins. Engineering Research Center.

TURBULENT EDDIES IN BOUNDARY LAYERS ON SMOOTH AND ROUGH FLAT PLATE

Shamsuzzaman Chowdhury Mar. 1966 140 p refs

(Contract DA-AMC-28-043-020)

(GER65SC-EJP57; AD-633915) CFSTI: HC $4.00/MF $1.00

This study represents one in a series of boundary layer investigations which are undertaken in order to obtain a definition of the roughness characteristics of a surface from the turbulence structure in the boundary layer near the surface. It is attempted to discuss the effect of the roughness in the structure of the turbulent eddies found near the boundary by comparing space correlations and spectra which were measured in the boundary layer on smooth and rough flat plates. The experimental investigations were made with a flat plate placed at a height of 2.0 ft. from the floor of a wind tunnel which had a 8 ft × 6 ft cross-section. The size of the plate used was 6 ft×3 ft. To obtain a rough surface condition, gravel which passed through a no. 7 sieve and

are retained on a no. 8 sieve was glued to the surface of the aluminum plate. The density of the roughness material was 120 particles per square inch. (TAB)

N66-34290# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.

TURBULENT FLOW OF DILUTE POLYMER SOLUTIONS—STUDIES IN COUETTE FLOW

Tae-Sup Lee (Ph.D. Thesis) May 1966 47 p refs

(Contract Nonr-3963(10))

(AD-633959) CFSTI: HC $2.00/MF $0.50

The purpose of the thesis was to investigate the phenomenon of drastic reduction of turbulent drag (friction stress) in a micromolecular liquid by the addition of soluble high-polymer substances. (TAB)

N66-34303# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.

HYPERSONIC FLOW ALONG TWO INTERSECTING PLANES

Robert J. Cresci Mar. 1966 36 p refs

(Contract AF 49(638)-1391)

(PIBAL-895; AFOSR-66-0500; AD-633949) CFSTI: HC $2.00/MF $0.50

The present paper deals with an experimental study of the viscous inviscid interaction occurring in a corner region under hypersonic, low density, free stream conditions. The tests were conducted in the Mach 11.8 hypersonic tunnel at PIBAL over a range of free stream Reynolds numbers between 0.15×10^6 and 0.50×10^6/ft. The model consists of two sharp edged plates mounted at an angle of 90 degrees with respect to each other and with normal leading edges. Data obtained include surface measurements of pressure and heat transfer for values of the interaction parameter between 1.0 and 20. The entire corner region is surveyed at a value of 2.5 and measurements of total temperature, pitot, and static pressure are obtained. The results indicate that the static pressure in the region of intersection of the shock layers is as much as twice that of the local two dimensional value. The local heat rates in this region are also considerably larger than their two dimensional counterparts. Author (TAB)

N66-34304# Science Engineering Associates, Inc., San Marino, Calif.

HYDRA 6 MODEL TESTS RESPONSE DUE TO WAVE ACTION Final Report, 6 Jan.–6 Mar. 1966

Donald H. Garbaccio Port Hueneme, Calif., Naval Civil Eng. Lab., Mar. 1966 20 p refs

(Contract NBy-62199)

(CR-66-004; AD-633948) CFSTI: HC $1.00/MF $0.50

Details are reported on the design for 1/20 linear scale model of an approximately 15,000 pound 40 foot long missile (hydra) now operated by the Naval Missile Center, Pt. Mugu, from a vertically floating position on the open ocean as a scientific space probe. Natural periods of model oscillation of 1.9 seconds in heave and 3.0 seconds in pitch are predicted. The model was built and proof tested. It is desired to improve missile stability in a seaway, hence, there is included a program for the measurement in the wave tank (100×2×3 feet high) of the response of the model freely floating in water 2.5 ft deep to regular waves of varying height up to 5.0 inches with period and length of respectively 0.90 seconds and 4.1 feet to 4.5 seconds and 38.8 feet. These measurements, besides steering missile modification where required, should assist in the prediction of missile response to seas up to state 4. Author (TAB)

N66-34408# Lockheed Missiles and Space Co., Palo Alto, Calif.

FLUID MECHANICS AND HEAT TRANSFER UNDER LOW GRAVITY

H. Cohan and M. Rogers, ed. [1965] 470 p refs Proc. of the symp. held at Palo Alto, Calif., 24–25 Jun. 1965 Sponsored by AFOSR

(AD-633580) CFSTI: HC $7.70/MF $2.25

CONTENTS:

1. SATURN V LOW GRAVITY FLUID MECHANICS PROBLEMS AND THEIR INVESTIGATION BY FULL-SCALE ORBITAL EXPERIMENT F. E. Swalley, G. K. Platt, and L. J. Hastings (NASA, Marshall Space Flight Center) 25 p refs (See N66-34409 20-31)

2. AN EXPERIMENTAL INVESTIGATION OF THE DYNAMIC BEHAVIOR OF THE LIQUID-VAPOR INTERFACE UNDER ADVERSE LOW-GRAVITATIONAL CONDITIONS W. J. Masica and J. A. Salzman (NASA, Lewis Res. Center) 18 p refs (See N66-34410 20-12)

3. INVISCID FLUID FLOW IN AN ACCELERATING AXISYMMETRIC CONTAINER P. Concus, G. E. Crane, and L. M. Perko 20 p refs (See N66-34411 20-12)

4. SOME THERMAL ASPECTS OF A CONTAINED FLUID IN A REDUCED-GRAVITY ENVIRONMENT S. H. Schwartz and M. Adelberg (Douglas Aircraft Co.) 47 p refs (See N66-34412 20-33)

5. DISTRIBUTION OF NONCONDENSABLE GASES IN LIQUIDS UNDER LOW-g CONDITIONS N. E. Welch and E. Funk (NASA, Marshall Space Flight Center) 19 p refs (See N66-34413 20-12)

6. THE FLUID MECHANICS OF CONDENSING MERCURY IN A LOW-GRAVITY ENVIRONMENT R. T. Lancet, P. Abramson (N. Am. Aviation), and R. P. Forslund (MIT) 52 p refs (See N66-34414 20-12)

7. DYNAMIC RESPONSE OF LIQUIDS IN PARTIALLY FILLED CONTAINERS SUDDENLY EXPERIENCING WEIGHTLESSNESS F. C. W. Fung (Cornell Aeron. Lab.) 32 p refs (See N66-34415 20-12)

8. LOW-GRAVITY LIQUID REORIENTATION M. P. Hollister and H. M. Satterlee 32 p refs (See N66-34416 20-12)

9. INTERFACIAL STABILITY OF LIQUID LAYERS ON ELASTIC SURFACES R. D. Smith 35 p refs (See N66-34417 20-12)

10. SLOSHING OF A LIQUID IN A DRAINING OR FILLING TANK UNDER VARIABLE G CONDITIONS P. G. Bhuta and L. R. Koval (TRW Space Technol. Labs.) 24 p refs (See N66-34418 20-12)

11. THE EFFECT OF WALL ELASTICITY AND SURFACE TENSION ON THE FORCED OSCILLATIONS OF A LIQUID IN A CYLINDRICAL CONTAINER P. Tong and Y. C. Fung (Calif. Inst. of Tech.) 4 p refs (See N66-34419 20-12)

12. SHAPE AND STABILITY OF THE LIQUID-GAS INTERFACE IN A ROTATING CYLINDRICAL TANK AT LOW g J. G. Seebold and W. C. Reynolds (Stanford Univ.) 17 p refs (See N66-34420 20-12)

13. MENISCUS SHAPE UNDER REDUCED-GRAVITY CONDITIONS H. M. Satterlee and J. H. Chin 24 p refs (See N66-34421 20-12)

14. LIQUID SETTLING IN LARGE TANKS T. E. Bowman (Martin Co.) 21 p refs (See N66-34422 20-12)

15. THE MARTIN COMPANY'S LOW-g EXPERIMENTAL FACILITY H. L. Paynter (Martin Co.) 17 p refs (See N66-34423 20-11)

16. THE APPLICATION OF HYDROPHILIC AND HYDROPHOBIC SURFACES FOR PHASE SEPARATION IN A LOW-g ENVIRONMENT J. M. Smith, R. M. Cima, and Y.-s. Li 20 p (See N66-34424 20-05)

N66-34410# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN EXPERIMENTAL INVESTIGATION OF THE DYNAMIC BEHAVIOR OF THE LIQUID-VAPOR INTERFACE UNDER ADVERSE LOW-GRAVITATIONAL CONDITIONS

William J. Masica and Jack A. Salzman *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 18 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The liquid-vapor interface in response to an adverse constant translational acceleration, positively directed from the vapor to liquid phase was investigated. The results are divided into three phases: the stability characteristics of the interface, the quantitative description of the motion of the interface, and the mechanism of reorientation or collection of liquids. The discussion of the stability characteristics of the interface is limited to the methods used to acquire the data and the results indicating the validity of the Bond number criterion as the scaling parameter in an induced low gravity environment. The motion of the liquid-vapor interface in cylindrical containers is correlated with the applied acceleration and certain system parameters. The profile of the interface, following its disruption by an adverse axial acceleration larger than critical, has been noted to assume the form predicted by the inviscid potential theory of G. I. Taylor. The leading edge of the interface was found to accelerate over distances comparable to fineness ratios of two. The mechanism of the reorientation or collection mode of Centaur/Saturn geometrical models was investigated in low acceleration environments. The worst condition of propellant location, i.e., the liquid located at the vent portion of the tank model was assumed. Following a period of weightlessness, an acceleration is imposed on the system to relocate the liquid at the desired pump inlet portion of the models. While information to date on the mode of collection has been largely qualitative, significant results were obtained. Despite the existence of a prominent "geyser" when the leading edge impinges on the bottom of the tankage, it was noted that a large portion of the liquid is being collected. Methods for alleviating the recirculation problem in collection were investigated and the results are presented. Author

N66-34411# Lockheed Missiles and Space Co., Palo Alto, Calif.

INVISCID FLUID FLOW IN AN ACCELERATING AXISYMMETRIC CONTAINER

P. C. Concus, G. E. Crane, and L. M. Perko *In its* Fluid Mech. and Heat Transfer Under Low Gravity [1965] 20 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

A numerical procedure has been developed for computer simulation of an axially symmetric, incompressible, irrotational flow of an inviscid fluid. The method is based on a determination of the velocity potential throughout the fluid satisfying the free-surface boundary condition, to determine the motion of individual particles on the surface via the kinematic equation. The work to date includes the surface tension as a smoothing term in the computation. Some difficulty was experienced in this approach, and various new methods for treating the surface tension through Bernoulli's equation are being investigated. For example, the equation itself can be viewed as the differential equation which, with the boundary conditions, defines the surface shape. Such a computation would maintain a constant contact angle and should increase stability of the method. Stability is also being viewed from a numerical standpoint, and it is believed that a modified orthonormalization routine will improve stability. An existing numerical program based on a Fourier series representation for the velocity potential will be used in conjunction with a finite difference technique, in the corner formed by the wall-liquid-air interface. This work describes the fluid motion for various initial shapes, accelerations, and surface tensions, and the stable problem in which surface oscillations are obtained. It is found that the period of oscillation is comparable to that predicted by the linear theory for small oscillations. The present object of concentration is the unstable problem where the liquid runs up the walls of the container. Author

N66-34413# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DISTRIBUTION OF NONCONDENSABLE GASES IN LIQUIDS UNDER LOW-G CONDITIONS

N. E. Welch and E. Funk *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 18 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

This paper discusses the liquid-vapor and noncondensable liquid gas distributions produced under highly turbulent flow conditions and under different degrees of mechanical agitation. Specifically discussed is the determination of the initial distribution produced from an arbitrary energy input under variable g fields. The results obtained merely provide the initial condition for the time-dependent distribution function, which provides the means for calculating the probability that a sufficiently large vapor space will be found near the suction lines at the time of restart to produce "vapor lock." Since the space is limited, the time-dependent functions and derivations are deleted. Furthermore, since the time-dependent functions describe the probability of failure of a specific space vehicle under specified restart conditions, the authors feel that this information should be withheld at the present. The utilized data were obtained under 1-g conditions. The distribution function was formulated by superimposing a theoretical distribution function derived for zero-g conditions or a semi-empirical distribution function dependent on the acceleration field. The theory was verified within the experimental error. The predicted low-g distribution was not verified. Author

N66-34414# North American Aviation, Inc., Canoga Park, Calif. Atomics International Div.

THE FLUID MECHANICS OF CONDENSING MERCURY IN A LOW-GRAVITY ENVIRONMENT

R. T. Lancet, P. Abramson, and R. P. Forslund (MIT) *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 52 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

Experimental and analytical results are presented for condensing mercury (Hg), which show that vapor and liquid pressures, drag, and momentum, with proper design, are adequate to maintain stable vapor-liquid interfaces during all phases of ground and orbital operation. Transient temperature and pressure distributions are presented for the startup phase of a multiple-tube horizontal radiator condenser during system operation. The indicated behavior of the liquid-vapor interfaces during startup is shown. Confirmation of such behavior is provided by motion pictures of Hg condensing in a single glass tube. Instabilities are analyzed and related to their effect on the performance of the Mercury Rankine Program power system. Interface instability as controlled by surface tension, tube size, and gravitational forces is discussed, along with runback and liquid-leg instability due to negative accelerations. Inherent instabilities controlled by the relations between the momentum recovery, friction and drag pressure losses, and condensing length are also discussed. A brief description is made of the facility used for studying the phenomenon of condensing Hg. Three analytical models for describing the pressure drop associated with two-phase flow of Hg are developed and discussed. Two recent modifications to these models are described. Author

N66-34415# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
DYNAMIC RESPONSE OF LIQUIDS IN PARTIALLY FILLED CONTAINERS SUDDENLY EXPERIENCING WEIGHTLESSNESS
Francis C. W. Fung *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 32 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The problem of dynamic response of liquid in partially filled containers after sudden removal of body forces is solved as an initial boundary-value problem for both two-dimensional and cylindrical containers. The initial free surface is assumed to be symmetrical with respect to the vertical axis of the containers, thus restricting the analyses to unidirectional body forces acting along the vertical axis. Additional assumptions are that the flow is inviscid and that the slope of the free surface is everywhere small, so that the problem can be linearized. It is found a posteriori that the linearizing assumptions are justified as long as cot β is small compared to unity, where β is the contact angle. Under these assumptions, the free-surface response can be represented by an infinite series of surface waves. It is found that the amplitudes of the higher modes diminish as $1/n^4$ for the two-dimensional case, and as $1/Z_n^4$ for the cylindrical case (where n=1,2,3. . . and Z_n are zeros of Bessel function of first kind and first order). The dynamic free surface shapes with cot $\beta<1$ are derived for both wetting or nonwetting liquids. This linearized analysis yields a time law for the free-surface vertex motion that compares favorably with experimental observations. The free-surface shape agrees well with the observed general shape. Author

N66-34416# Lockheed Missiles and Space Co., Palo Alto, Calif.
LOW-GRAVITY LIQUID REORIENTATION
M. P. Hollister and H. M. Satterlee *In its* Fluid Mech. and Heat Transfer Under Low Gravity [1965] 32 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The reorientation of liquids in cylindrical containers under the action of low and high acceleration (or gravity) was studied. Using a 25-ft drop facility experiments were performed with carbon tetrachloride in a lucite cylinder of 3.18-cm radius. By accelerating the test specimen parallel to the cylinder axis during free fall, reorientation Bond numbers of 8.7 and 185 were produced. The reorientation flow was observed photographically. Flat, convex, and concave tank bottom shapes as well as varying liquid depths were used. A numerical program was developed to calculate the time-dependent motion of the free surface of an inviscid, incompressible fluid subject to a constant or time-varying acceleration field acting along the cylinder axis. Only qualitative correlation between the numerical program and experiments was obtained. It was concluded that: (1) For a given initial flatness of the free liquid surface, there is a value of reorientation Bond number below which a single large bubble forms. Above this value, the free surface breaks in a complicated way, and liquid falls in the center of the cylinder. (2) When the initial free-surface shape is a segment of a sphere, only the single large bubble is formed. (3) The wavefront trajectory at the wall travels at less than the free-fall rate. For low B_R the wavefront response initially is more rapid. (4) The rise rate of the large central bubble is reduced as the bubble approaches a hemispherical tank end. Author

N66-34417# Lockheed Missiles and Space Co., Palo Alto, Calif.
INTERFACIAL STABILITY OF LIQUID LAYERS ON ELASTIC SURFACES
R. D. Smith *In its* Fluid Mech. and Heat Transfer Under Low Gravity [1965] 35 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The criteria associated with the dynamic stability of a liquid layer supported by an elastic surface are investigated theoretically by means of a linear vibration analysis. The investigation takes into consideration certain aspects concerning the orientation and stability of liquids stored in elastic containers of space vehicles operating under low-gravity conditions. It was assumed that a lyaer of incompressible, inviscid fluid having a flat liquid–gas interface is stored in a two-dimensional rectangular channel having either flexible walls or a flexible floor. To assess low-gravity conditions realistically, the effect of surface tension at the free surface of the fluid layer is taken into account. Particular emphasis is given to the study of the individual effects of the flexibility of the channel walls and floor on the stability criteria. A result of particular interest with regard to the design of elastic fluid containers for space vehicles is that, for a channel having a flexible floor, there is a finite upper bound for the range of values of g required for the dynamic stability of the system. This upper bound increases monotonically with the bending stiffness of the channel floor. Author

N66-34418# TRW Space Technology Labs., San Bernardino, Calif.
SLOSHING OF A LIQUID IN A DRAINING OR FILLING TANK UNDER VARIABLE G CONDITIONS
P. G. Bhuta and L. R. Koval *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 24 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The sloshing of a liquid in a tank which is subjected to variable accelerations along its axis in a gravitational field, and which may be in the process of being filled or drained, is studied. The complete formulation pertaining to the linearized problem of the free-surface oscillations in such a tank is given. The effects due to surface tension are included. It is shown that the equations reduce to the proper results in the limiting cases. The solutions of initial value problems for certain specific examples are given and the results for a draining tank indicate the possibility of a blowthrough of the vapor during zero-g draining. The results for a filling tank in a low-g environment show the need for the provision of adequate baffles to damp the free surface motion. Author

N66-34419# California Inst. of Tech., Pasadena.
THE EFFECT OF WALL ELASTICITY AND SURFACE TENSION ON THE FORCED OSCILLATIONS OF A LIQUID IN A CYLINDRICAL CONTAINER
P. Tong and Y. C. Fung *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 42 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The stability of a fluid contained in a circular cylindrical tank with a flat, flexible bottom under a periodic axial excitation is studied. A variational approach is formulated. An approximate solution results in a pair of coupled ordinary differential equations with periodic coefficients. A method of handling the stability of the solutions of such a system of equations is presented. Numerical results are discussed. Author

N66-34420# Stanford Univ., Calif.
SHAPE AND STABILITY OF THE LIQUID–GAS INTERFACE IN A ROTATING CYLINDRICAL TANK AT LOW G
J. G. Seebold and W. C. Reynolds *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 17 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

The equilibrium liquid–gas interface in a cylindrical tank rotating at constant angular velocity about its axis in an axial body force field is discussed. A variational principle leads to a boundary value problem associated with the equilibrium free surface and an eigenvalue problem associated with the stability of that surface. The principal results are a parametric stability map governing the existence of stable menisci and shape parameters of the possible equilibrium interface configurations. Experimental results provide qualitative support for the analysis. Author

N66-34421# Lockheed Missiles and Space Co., Palo Alto, Calif.
MENISCUS SHAPE UNDER REDUCED-GRAVITY CONDITIONS
H. M. Satterlee and J. H. Chin *In its* Fluid Mech. and Heat Transfer Under Low Gravity [1965] 24 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25
(Contract NAS8-11525; Grant NSF G-20090)

The shape of the capillary surface in a right circular cylinder is a function of the Bond number, B (ratio of gravitational forces to surface tension forces acting on the liquid), and the contact angle, θ (measured from the solid surface to the limiting tangent to the liquid–gas interface). The derivation of the differential equation for this capillary surface is given along with the results of numerical calculations for $0 \leq B < 81$ and $0° \leq \theta \leq 90°$. An ellipsoid of revolution approximation to the capillary surface shape is also developed. Experimental data regarding the shape of the capillary surface are reported together with the experimental techniques. Comparison of experimental data with numerical solutions indicates good agreement. Comparison of the ellipsoidal approximation to the numerical solutions indicates that the ellipsoidal approximation can be used for engineering calculations in the range $0 \leq B \leq 10$. Author

N66-34422# Martin Co., Denver, Colo.
LIQUID SETTLING IN LARGE TANKS
T. E. Bowman *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1965] 21 p refs (See N66-34408 20-12)
(Contract NAS8-11328) CFSTI: HC $7.70/MF $2.25

The problem of propellant settling (repositioning from forward to aft orientation) in large orbiting tanks, in which the liquid-vapor interface is initially flat, has been studied experimentally using scale models in a 75-foot drop tower. Accelerations up to 0.025 g, test cylinders up to one foot diameter, and Bond numbers up to 390 have been investigated within the limitation of a 2.16-second drop test. Several different types of flow were observed, not normally encountered in settling from a meniscus-shaped (zero-gravity configuration) surface; all can be explained on the basis of the initial Taylor instability. Except for certain secondary phenomena, Bond number was found to be a valid scaling parameter within the range studied. Although initial flow characteristics were studied rather extensively, no conclusions can be drawn (from these drop tower studies) about long-term aspects of settling, such as the time required before quiescent conditions are attained. Author

N66-34488# Office of Naval Intelligence, Washington, D. C. Translation Section.
THE STRUCTURE OF SHOCK WAVES IN AIR WITH ACCOUNT BEING TAKEN OF THE KINETICS OF CHEMICAL REACTIONS AND THE EXCITATION OF MOLECULAR VIBRATIONS OF NITROGEN [STRUKTURA UDARNYKH VOLN V VOZDUKHE S UCHETOM KINETIKI KHIMICHESKIKH REAKTSIY I VOZBUZHDENIYA MOLEKULYARNYKH KOLEBANIY AZOTA]
S. N. Anisimov, N. M. Kuznetsov, and E. F. Nogotov [1966] 19 p refs Transl. into ENGLISH from Termofiz. Vysokikh Temperatur (USSR), v. 2, no. 3, 1964 p 337–343
(ONI-TRANS-2142; AD-634228) CFSTI: HC $1.00/MF $0.50

By numerical integration of the kinetic equations for the chemical reactions and the relaxation equation for the excitation of molecular vibrations of nitrogen, the concentrations of the components, density, and temperature of the air behind the shock wave front were calculated. The calculations were carried out over a wide range of air densities and shock wave velocities. The question of extrema of pressure and density in the structure of the wave was considered. Author (TAB)

N66-34538# California Univ., Berkeley. Coll. of Engineering.
EXPERIMENTAL STUDY OF THE WAVE STRUCTURE OF MARGINAL DETONATION IN A RECTANGULAR TUBE
Gerald B. Steel Jan. 1966 44 p refs
(Grant AF-AFOSR-129-66)
(AS-66-4; AFOSR-66-0936; AD-634293) CFSTI: HC $2.00/MF $0.50

Wave structure of marginal detonations, propagated through nitrogen-diluted stoichiometric hydrogen–oxygen mixtures in a 1-3/4 in. by 3/4 in. rectangular tube, is studied by the soot technique and velocity probes. Both weak shocks and strong detonations are shown to propagate transversely behind the detonation front. In marginal detonations in rectangular tubes, waves propagate in both lateral directions behind the initial shock. Ordinarily, each wave is the weak reflected shock of a triple shock interaction. Occasionally, however, as the result of a complex shock interaction, a transverse detonation is developed behind the leading shock. This produces a trace in the form of a band on a tube wall that has been previously coated with carbon soot. The width of this band is governed by the induction delay behind the initial shock. By coupling its measurement with velocity data, induction times and temperatures are obtained from self-sustained detonations. Author (TAB)

N66-34542# Navy Dept., Washington, D. C.
THE STRUCTURE OF A SHOCK WAVE, CONSIDERING IMPULSE AND ENERGY TRANSFER BY RADIATION
V. S. Imshennik and Yu. I. Morozov 1964 27 p Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 2, 1964 *Its* Transl. 2003
(AD-634275) CFSTI: HC $2.00/MF $0.50

Translation of Russian research; the structure of a shock wave, considering impulse and energy transfer by radiation. TAB

N66-34669# Princeton Univ., N. J. Gas Dynamics Lab.
TURBULENT BOUNDARY LAYERS WITH ARBITRARY PRESSURE GRADIENTS AND DIVERGENT OR CONVERGENT CROSS FLOWS
George L. Mellor Mar. 1966 44 p refs
(Contract Nonr-1858(38); Grant NSF GS-578)
(Rept.-778; AD-635028) CFSTI: HC $2.00/MF $0.50

A turbulent viscosity hypothesis which has been previously verified for equilibrium boundary layers is now applied to incompressible boundary layers with arbitrary mainstream pressure variations. The empirical content of the turbulent viscosity hypothesis (which is the von Karman constant) is solely derived from constant pressure profile data. The present work is an extension of the previous work in that the mean differential equations of motion are integrated numerically. This time, however, one must deal with partial differential equations instead of the similar, ordinary differential equations applicable to equilibrium flows. An important

result is that prediction of the skin friction coefficient and separation is very good. Consideration of divergent or convergent cross flows (secondary flows) is included in the paper. Author (TAB)

N66-34894# Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.

THREE-DIMENSIONAL MOMENTUMLESS WAKES IN DENSITY-STRATIFIED LIQUIDS Final Report

Philip J. Stockhausen, Charles B. Clark, and John F. Kennedy Jun. 1966 109 p refs *Its* Rept.-93

(Contract Nonr-1841(59))

(T66-6; AD-635151) CFSTI: HC $6.00/MF $0.75

Experiments were performed to investigate the configuration and surface effects of the turbulent wake generated by a self-propelled body moving in a linearly density-stratified liquid. The experiments were performed in a 50-foot long tank filled to a depth of 2 1/2 ft. For all experiments, the Reynolds number, based on the diameter of the circular disc mounted on the model's bow, was 89,000. It was found that the mixed region generated by the turbulent wake rapidly attained a maximum vertical extent, and then collapsed vertically while continuing to expand laterally. The vertical collapse of the wake was accompanied by the convergence toward the model of the fluid at the free surface. The convergence did not occur with homogeneous liquids. It was concluded that this surface convergence is possible only if the turbulent wake extends to the free surface. A new method was developed for generating linear density profiles in large tanks. Author (TAB)

N66-34807*# Mississippi State Univ., State College. Dept. of Mechanical Engineering.

STUDY OF PRESSURE LOSSES IN TUBING AND FITTINGS. Final Report, Jun. 1, 1964–Jun. 1, 1966

C. W. Bouchillon and C. T. Carley, Jr. [1966] 130 p refs

(Contract NASS-11297)

(NASA-CR-77271) CFSTI: HC $4.00/MF $1.00 CSCL 20D

The objectives were to develop means of predicting the performance of tubing and fitting systems for steady state and transient fluid flows. One of the major results is an empirical equation which predicts the friction factor for flow through flexible metal hoses of various geometric configurations. Another result is a computer program for prediction of the performance of a generalized system for steady state and slow transient, i.e., quasi-steady state phenomena which may be applied to many configurations, including systems with flexible corrugated metal hoses. Development of analyses for the improvement of the prediction equation for the corrugated flexible metal hose as a function of the geometry of the hose convolutions continues. The prediction of transient phenomena in tubing and fitting systems will require additional research for solving the resultant partial differential equations. Author

N66-34841*# Wyle Labs., Inc., Huntsville, Ala.

THE FLUCTUATING PRESSURES DUE TO SHOCK INTERACTIONS WITH TURBULENCE AND SOUND

M. V. Lowson Jun. 1966 42 p refs

(Contract NASS-11308)

(NASA-CR-77313; WR-66-35) CFSTI: HC $2.00/MF $0.50 CSCL 20D

High levels of pressure fluctuation have been observed on surfaces beneath shock waves in turbulent flow. It is shown here that the interaction between the turbulence and shock is sufficient to account for the observed fluctuating pressure field. Computations have been performed following the methods of Ribner, explicitly including the nearfield pressure terms. It has been found that, for instance, the interaction of turbulence of intensity 0.05 with a typical separation shock at M=2.0 will generate a near field noise level of 164 dB. The contribution of shock motion, due to turbulence, to surface pressure fluctuations has been studied. The interaction between shocks and sound has been studied. The predicted magnification of incident sound behind the shock (4.5 dB for a M=2.0 separation shock) is probably sufficient to account for the observed sensitivity of an oscillating shock to wind-tunnel noise. Author

N66-34688# Gt. Brit. Ministry of Aviation, Mottingham. Technical Information and Library Services.

TURBULENT BOUNDARY LAYER ON A FLAT PLATE IN AN INCOMPRESSIBLE FLUID [TURBULENTNYI POGRANICHNYI SLOI NA PLOSKOI PLASTINE V NESZHIMAEMOI ZHIDKOSTI]

G. S. Glushko May 1966 23 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mekh. (USSR), v. 4, Jul.–Aug. 1965 p 13–23

(TIL/T-5664) CFSTI: HC $1.00/MF $0.50

The effective viscosity arising from the Re stresses is a function only of the Re number of the turbulence, made up of the total turbulent energy, scale of turbulence and molecular viscosity. This function is universal for boundary layer type turbulent flows and independent of the presence of a pressure gradient. Author

N66-34718# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

TURBULENT FLOW IN AN ANNULUS

S. Levy Oct. 1965 20 p refs

(Contract AT(04-3)-189)

(GEAP-4976) CFSTI: HC $1.00/MF $0.50

Equations describing fully developed turbulent flow in an annulus are derived. They are based upon Reichardt's expression for the eddy diffusivity of momentum, and they assume that the velocity profiles starting from the core tube wall and the outer tube wall have the same velocity and eddy diffusivity at the plane of zero shear. The predicted location of the plane of zero shear, mixing length, eddy diffusivity, velocity distribution, and friction factor are compared to available data and are found to give good agreement with the test results. Potential extension of the proposed method to more complex geometries is illustrated by considering the case of flow in an annulus with one artificially roughened surface. Author (NSA)

N66-34771# David Taylor Model Basin, Washington, D. C.

CAVITATION INCEPTION ON THREE-DIMENSIONAL ROUGHNESS ELEMENTS Final Report

Bruce W. Benson May 1966 36 p refs

(DTMB-2104; AD-634319) CFSTI: HC $2.00/MF $0.50

Cavitation inception velocities have been measured for the flow over three-dimensional roughness elements, embedded in a boundary layer on a flat plate, in the 36-inch water tunnel at the David Taylor model basin. The roughness elements considered are right circular cylinders, cones, and hemispheres whose heights vary from one-thirty-second to three-forths of an inch. Cavitation inception number, based on tunnel velocity, is plotted as a function of the ratio of roughness height to boundary layer thickness. This resulted in separate curves for each test velocity. When, however, the cavitation number was computed on the basis of the velocity within the boundary layer at the tip of the roughness, the cavitation number was found to be primarily a function of the local Reynolds number, based on roughness height and

local velocity, of the three roughness geometries, the cylinders produced the largest cavitation numbers; the hemispheres, the smallest. Author (TAB)

N66-34871# Naval Ordnance Test Station, China Lake, Calif.
TURBULENT BOUNDARY-LAYER CALCULATIONS USING A LAW OF THE WALL—LAW OF THE WAKE METHOD
D. M. Nelson Jun. 1966 63 p refs
(NOTS-TP-4083; AD-634842) CFSTI: HC $3.00/MF $0.75

Theoretical development of a law of the wall-law of the wake, incompressible, turbulent boundary layer calculation method was published. As a follow-on, the method is used here to obtain practical boundary layer solutions, solving the equations on a high-speed computer and comparing the theoretical calculations with experimental data. It was necessary to make several modifications to the basic method, the most important being the inclusion of a way to give the boundary layer solution a memory. The calculation method appears able to yield satisfactory engineering answers for two-dimensional and axisymmetric boundary layers that develop in pressure distributions containing regions of adverse pressure gradient, favorable pressure, and zero or nearly zero pressure gradient. Author (TAB)

N66-34873# Douglas Aircraft Co., Inc., Long Beach, Calif.
PROGRESS IN SOLVING THE FULL EQUATIONS OF MOTION OF A COMPRESSIBLE TURBULENT BOUNDARY LAYER
A. M. O. Smith, N. A. Jaffe, and R. C. Lind Jun. 1966 24 p refs Presented at the 7th BOWACA Symp. on Aeroballistics, Naval Missile Center, Point Mugu, Calif., 7–9 Jun. 1966
(Douglas Paper-3925; AD-634988) CFSTI: HC $1.00/MF $0.50

The equations of motion governing both compressible and incompressible flow are presented, and the general method of solution is outlined. The equations cover both axially symmetric and two-dimensional flows. A transverse term is retained in order to solve the problem of relatively thick boundary layers on bodies of revolution. The eddy-transport formulas are emphasized, and the viscosity formulation for incompressible flow is extended to cover compressible flow. A finite-difference net is used in which the meshes are not of uniform size, but in which the intervals between lines increase with distance from the wall in such a way that the ratio of lengths of any two adjacent steps is a constant. Some results are given for the case of incompressible flow. N.E.N.

N66-34975# General Electric Co., Schenectady, N. Y. Research and Development Center.
STUDY OF THE SURFACE FILMS OF GAS NUCLEI (AS RELATED TO CAVITATION AND TENSILE STRENGTH IN WATER), PART 2 Final Report, Jan. 1965–Dec. 1966
Leslie H. Bernd Jan. 1966 50 p refs
(Contract Nonr-4296(00))
(TIS-66-C-164; AD-632695) CFSTI: HC $2.00/MF $0.50

Cavitation produces gas nuclei in water. Trace materials in the water produce surface films about nuclei. Certain films prevent dissolving of nuclei and the acquisition of tensile strength. Conversely, the absence of films makes for rapid dissolving and the acquisition of tensile strength. Tensile strength is undesirable and leads to errors in cavitation testing. Water from various test facilities was therefore tested for film formation to determine the likelihood of acquiring tensile strength. Most of the water was found to have negligible film formation, and rapidly acquired tensile strength after cavitation. Various protein and hydrocarbon materials were used to produce surface films about nuclei to investigate film action, and find materials suitable for controlling dissolving. It was found possible by this means to produce water that ranged from no tensile strength gain after cavitation, to varying degrees of dissolving and tensile strength gain. It was found possible to match the various waters. Author (TAB)

N66-34997# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Freiburg (West Germany). Institut für Angewandte Mathematik und Mechanik.
PERIODIC LONGITUDINAL VORTICES IN TURBULENT BOUNDARY LAYERS ALONG CONCAVE WALLS [UEBER DAS AUFTRETEN VON LAENGSWIRBELN IN TURBULENTEN GRENZSCHICHTEN AN KONKAVEN WAENDEN]
G. Sandmayr Jun. 1966 54 p refs In GERMAN; ENGLISH summary
(DVL-504; DLR-FB-66-41) CFSTI: HC $3.00/MF $0.50

The existence of periodic longitudinal vortices in a turbulent boundary layer along a concave wall is investigated. In addition to the velocity profile, a profile of the eddy viscosity and the Reynolds number are given. The eigenvalue problem is approximatly solved by Galerkin's method for a particular boundary layer described by P. S. Klebanoff and for neutral disturbances. The curve of critical curvature has a minimum for a certain wave length of the disturbance and does hardly change with the Reynolds number in a certain range of this parameter. These results are in agreement with experiments by I. Tani. Author

N66-34998# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Institut für Theoretische Gasdynamik.
ON THE THEORY OF THIN SHOCK LAYERS [UEBER DIE THEORIE DUENNER HYPERSCHALLSTOERSCHICHTEN]
W. Schneider Jun. 1966 38 p refs In GERMAN; ENGLISH summary
(DVL-539; DLR-FB-66-42) CFSTI: HC $2.00/MF $0.50

Starting from a critical representation of the well-known theory of Freeman, Chester, and Lighthill, a method is developed to calculate the inviscid hypersonic flow of a real gas past blunt bodies of revolution. A solution, valid from the stagnation point up to large distance from the body, is given. Contrary to the solutions of Freeman, Chester, and Lighthill, the new results show no singularities. Author

N66-35027# Case Inst. of Tech., Cleveland, Ohio. Engineering Div.
VELOCITY AND PRESSURE MEASUREMENTS OF PULSATING FLOW IN A FLEXIBLE TUBE
Burghard H. Ruterbories and Simon Ostrach Jun. 1966 97 p refs Sponsored by the Heart Assoc. of Northeastern Ohio
(FTAS/TR-66-10)

This thesis is concerned with measurements of velocity and pressure in an experimental apparatus simulating the important aspects of arterial flow in the larger blood vessels. The maximum velocity during the pulse over the time average mean velocity, is taken to be representative of the velocity profile shape. Changes in this variable in terms of independent variation of three nondimensional parameters considered to be those governing pulsating flow in flexible tubes are presented and discussed. Simultaneously recorded pressure changes are included. In addition actual velocity profiles are determined experimentally for different test conditions in the flexible tube and for comparison also in a rigid tube of equal dimensions. The question of axial flow development is investigated qualitatively by measuring velocity profiles at different axial stations. Author

N66-35032# Aeronautical Research Council (Gt. Brit.)
EXPERIMENTAL INVESTIGATION OF THE BREAKDOWN OF A VORTEX IN A TUBE
D. L. I. Kirkpatrick 1965 22 p refs
(ARC-CP-821; RAE-TN-AERO-2983; ARC-26227) Supersedes RAE-TN-AERO-2983; ARC-26227 CFSTI: HC $1.00/MF $0.50

The distribution of the total pressure and the angle of swirl across a vortex in a tube were measured using a pitot probe upstream of breakdown. The static pressure distribution along the length of the tube containing the breakdown was also measured. It was found that the total pressure fell sharply in the vortex core towards a very low value on the axis, and that the swirl-angle distribution was similar to that of an exponential vortex. The static pressure distribution along the wall of the tube was found to include a positive pressure gradient upstream and a negative pressure gradient downstream of the breakdown's position. When breakdown did not occur these pressure gradients were not present. From the total pressure and swirl-angle distributions across the vortex, the static and dynamic pressure distributions and the axial and circumferential velocity distributions were calculated. These results will be used as boundary conditions for numerical solution of the equations of motion of the vortex. Author

N66-35034# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Aerodynamik.
THE CALCULATION OF SOLUTIONS OF THREE-DIMENSIONAL LAMINAR BOUNDARY LAYERS WITH SIMILARITY ALONG LINES [DIE BERECHNUNG LINIENHAFT AEHNLICHER LOESUNGENBEI DREIDIMENSIONALEN LAMINAREN GRENZSCHICHTEN]
W. Wuest Apr. 1966 45 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-29; AVA-FB-66-05) CFSTI: HC $2.00/MF $0.50

The solutions of boundary layers in three-dimensional flow are generally dependent on three spatial coordinates. For specially prescribed outer flows one succeeds in transforming the differential equations in such a manner that they depend only on two or even on one variable ("solutions with line or area similarity"). Examples are calculated for outer flows corresponding to power laws in x and y. Author

N66-35038# Institut für Elektronen und Ionenforschung, Munich (West Germany).
EXPERIMENTAL INVESTIGATIONS ON THE FRICTION DRAG OF AN OSCILLATING DISK IN INERT GASES, AIR AND OTHER OXYGEN-NITROGEN MIXTURES BY DETERMINATION OF THE LOGARITHMIC DECREMENT OF DAMPING WITHIN A RANGE OF PRESSURE COVERING APPROXIMATELY 760 TO 10^{-2} TORR [EXPERIMENTELLE UNTERSUCHUNGEN DES REIBUNGSWIDERSTANDES EINER SCHWINGENDEN SCHEIBE IN EDELGASEN, LUFT UND IN ANDEREN SAUERSTOFFSTICKSTOFF-GEMISCHEN DURCH BESTIMMUNG DES LOGARITHMISCHEN DAEMPFUNGSDEKREMENTS IM DRUCKBEREICH VON ETWA 760 BIS 10^{-2} TORR]
Feb. 1966 44 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-28) CFSTI: HC $2.00/MF $0.50

The effect of diverse gases (inert gases, non-inert gases and gas mixtures) on the friction drag was examined based on the measurement of the logarithmic decrement of damping of an oscillating aluminum disk. Without altering the measuring devices comparing measurements of the logarithmic decrement were made covering the pressure range of approximately 760 to 10^{-2} Torr with regard to (a) the inert gases helium, neon, argon, krypton and xenon, (b) the non-inert gases oxygen and nitrogen, and (c) the gas mixtures oxygen-nitrogen, especially air. Author

N66-35139# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut für Strahlantriebe.
THE TIME-LAG OF PRESSURE READINGS THROUGH HOSE PIPES, PART I [DRUCKANZEIGEVERZOEGERUNGEN DURCH SCHLAUCHLEITUNGEN, TEIL I]
N. Schmidt 20 Jan. 1966 44 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-27) CFSTI: HC $2.00/MF $0.50

The time-lag of pressure reading due to connecting tubes, as known from aerodynamic investigations and measuring equipments in operating wind tunnels, is theoretically calculated. Part I is presuming a gas flow without friction in the tubing and a constant dead volumen of the transducer. Basic assumptions of the theoretical calculation are isentropic flow through the probe orifice and isothermic change of state of the tubing volumen. Results are presented as graphs. Criteria are given to estimate the influence of wave propagation and gas oscillations. Author

N66-35212*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FLOW AND PRESSURE FIELD ANALYSIS OF PARALLEL GROOVE GEOMETRY FOR AN INCOMPRESSIBLE FLUID WITH CONVECTIVE INERTIA EFFECTS
John Zuk, Lawrence P. Ludwig, and Robert L. Johnson Washington, NASA, Sep. 1966 38 p
(NASA-TN-D-3635) CFSTI: HC $2.00/MF $0.50 CSCL 20D

A set of two-dimensional equations that includes both convective inertia and viscous forces were formulated for parallel groove geometries. They are solvable for the velocity and pressure distribution and optimum geometry by using numerical methods on a high-speed digital computer. The mathematical model consisted of a smooth flat plate moving relative to a fixed parallel groove-ridge surface. A modified Reynolds number evolved that is based on a groove-ridge characteristic length parallel to the smooth plate velocity vector. Convective inertia can only be neglected if the modified Reynolds number is much less than 1. Application of the modified Reynolds number to four published experimental results reveals that a significant improvement in bearing number or sealing coefficient occurred when the Reynolds number was near 1, and is argued to be due to the strong influence of convective inertia. The consideration of convective inertia effects reveals that fluid density ρ, aspect ratio b/h_o, and number of groove-ridge pairs N are additional parameters of pressure generation dependence that are not implied in the creeping flow analysis. The analysis provides a unified approach to parallel groove operation. The analysis and resulting equations apply equally to hydrodynamic seals, bearings, and pumps. An arbitrary groove-ridge shape is also permissible in solving the equations. Consideration of convective inertia effects explains the principle of viscoseal axial pressure generation and attainment of zero leakage. Author

N66-35282# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Aerodynamik.
APPROXIMATE DETERMINATION OF THE FLOW FIELD ON A PROFILE WITH NOSE BLOWING AND SUPERSONIC FREE STREAM [NAEHERUNGSWEISE ERMITTLUNG DES STROEMUNGSFELDES AN EINEM PROFIL MIT NASENAUSBLASUNG BEI UEBERSCHALLANBLASUNG]

W. Wuest Feb. 1966 36 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-09; AVA-FB-66-01) CFSTI: HC $2.00/MF $0.50

A number of methods have been developed for the calculation of the flow on a blunt body with detached shock wave. They are, however, not directly applicable to case of nose blowing. It will be tried, in the following, to gain at least an approximate idea of the flow field by combining the incompressible blowingout flow with an appropriate outer shock flow. Author

N66-35310*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
A RELATIONSHIP BETWEEN PITZER'S ACENTRIC FACTOR AND THE MORSE INTERMOLECULAR POTENTIAL
Daniel D. Konowalow 28 Jun. 1965 8 p refs Submitted for Publication
(Grant NsG-275-62)
(NASA-CR-68754; WIS-TCI-107) CFSTI: HC $1.00/MF $0.50 CSCL 20D

A connection is found between Pitzer's acentric factor and the parameter c which governs the curvature of the Morse potential function at its minimum. This not only provides a physical interpretation for c, but also has practical implications which are explored briefly. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-34105 # Air Force Technical Applications Center, Washington, D. C.
MAGNITUDE DETERMINATION AT REGIONAL AND NEAR-REGIONAL DISTANCES IN THE UNITED STATES
Jack F. Evernden 30 Aug. 1965 145 p refs
(VU-65-4A; AD-634137) CFSTI: HC $4.00/MF $1.00

This report deals with the problems of variation of P_n amplitudes in the regional and near-regional distance ranges (200–2100 kilometers). The data used were recorded by long range seismic measurement (LRSM) vans of the VELA seismological center as a result of earthquakes throughout the United States and numerous nuclear and chemical explosions in the same region. It is shown that the patterns of P_n amplitudes versus Δ in western and eastern United States (WUS and EUS) are markedly different and that these differences are related to different velocity structures in the two regions. These differences extend to at least 160 kilometers depth. Neither the WUS nor EUS patterns conform even approximately to that predicted or suggested by Gutenberg and Richter in the 1000-2000 kilometer range. The hypothesized shadow-zone does not exist and over-estimation of magnitude by as much as 1.5 magnitude units is frequently done because of failure to properly understand the patterns of radiation. By proper calibration of WUS by use of numerous events, it is now possible to get consistent estimates of magnitude at all distance ranges for most explosions and earthquakes. This is very important when body wave magnitudes are used as an essential element in an identification criterion. Author (TAB)

N66-34180# Oregon State Univ., Corvallis. Dept. of Oceanography.
OREGON STATE UNIVERSITY SEISMOLOGICAL BULLETIN NO. 7 Quarterly Report, 1 Jan.–31 Mar. 1965
A. J. Skorpen, John N. Gallagher, and Peter Dehlinger Apr. 1966 19 p *Its* Data Rept.-22
(Contracts AF 19(628)-2778; Nonr-1286(10))
(AD-634349) CFSTI: HC $1.00/MF $0.50

The report includes seismic data recorded at the Corvallis, Klamath Falls, and Portland, Oregon, seismic stations from January 1 to March 31, 1965. Author (TAB)

N66-34202# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
STRATOSPHERIC TIDAL CIRCULATIONS
Willis L. Webb Jun. 1966 15 p refs Presented at Army Sci. Conf., West Point, N. Y., 14–17 Jun. 1966
(AD-634650) CFSTI: HC $1.00/MF $0.50

A description of the temperature and wind fields, based on the gross thermal response to the diurnal heat input and the resulting wind oscillation, is developed. The stratospheric diurnal heat wave, its propagation from the east, and its speed variation are discussed. A most important effect was considered to be the mixing of constituents such as water vapor or oxygen. A hypothetical picture of the stratospheric tidal motions is presented, and the equatorial electro jet is described. The tidal jet generated by diurnally rotating heat wave is also discussed, and strong support for the presence of turbulent variable tidal jet in the middle and upper mesosphere, with occasional eddy transport across the mesopause into the lower ionosphere, was found. The relationships between stratospheric tidal and general circulations is summarized. N.E.N.

N66-34212# Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.
AIRCRAFT-INDUCED IONOSPHERIC DISTURBANCES Scientific Interim Report
Frank A. Marcos Apr. 1966 34 p refs *Its* AF Surv. in Geophys. no. 175
(AFCRL-66-229; AD-634775) CFSTI: HC $2.00/MF $0.75

Experiments were conducted to determine whether acoustic waves could propagate from the lower atmosphere into the ionosphere and be detected by hf radio waves. A supersonic aircraft was flown on a trajectory designed to focus the shock wave energy, generated over a long flight path, into a relatively small region of the daytime E-layer which was being probed by a phase path vertical sounder. Three series of tests, consisting of four flights each, were made. In each series, perturbations were found in the frequency spectrum of reflected radio waves that could be well correlated with the expected disturbance from aircraft-generated shock waves. Author (TAB)

N66-34219# Inter-Range Instrumentation Group, White Sands Missile Range, N. Mex. Meteorological Rocket Network Committee.
METEOROLOGICAL ROCKET NETWORK FIRINGS Volume XLIX: SEPTEMBER 1965 FIRINGS Data Report
Apr. 1966 153 p ref
(IRIG-109-62, Vol. XLIX; AD-634381) CFSTI: HC $5.00/MF $1.00

The meteorological rocket network (MRN) combines the investigative efforts of a number of meteorological organizations engaged in upper atmospheric studies. Each report contains the wind and temperature measurements from all available network firings for the particular month, and includes the radiosonde observations nearest the time of firing. Release time of the radiosonde should be within ±6 hours of the time of firing. However, exceptions up to ±12 hours are made, particularly in tropical regions. Since only those firings which yield significant data are of

interest here, the report does not include unsuccessful firings. Meteorological rocket network stations which have contributed data are listed in the index. Any data delayed and thus omitted from previous publications will appear in a second addendum. TAB

N66-34254# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.

HYDROMAGNETIC EMISSIONS AT THE GEOMAGNETIC POLES

E. M. Wescott, V. P. Hessler (Alaska Univ.), and J. F. Kenney May 1966 11 p refs Prepared jointly with Alaska Univ.
(Grant NsF GA-268)
(DI-82-0534; AD-634262)

A micropulsation experiment has been in operation since December 1964 near the magnetic poles at Camp Tuto, Greenland, and Vostok, Antarctica. The purpose of the experiment is to investigate the character of micropulsation activity in the polar region, where field line conjugacy probably does not exist. Examples of some pearl micropulsations observed simultaneously at the two sites are given. Preliminary measurements of the delay time between reception of pearls at College, Alaska and Camp Tuto, Greenland indicate that these emissions originate in the auroral zone and propagate away from that region in an ionospheric duct.
Author (TAB)

N66-34257 # Lincoln Lab., Mass. Inst. of Tech., Lexington.

A FREQUENCY-DOMAIN SYNTHESIS PROCEDURE FOR MULTIDIMENSIONAL MAXIMUM-LIKLIHOOD PROCESSING OF SEISMIC ARRAYS

Jack Capon, Roy J. Greenfield, and Robert J. Kolker 6 May 1966 86 p refs
(Contract AF 19(628)-5167; ARPA Order 512)
(TN-1966-29; ESD-TR-66-203; AD-634233) CFSTI: HC $8.60/MF $0.75

A frequency-domain synthesis method for multidimensional maximum-likelihood filtering of sampled data obtained from seismic arrays is presented. This procedure is shown to possess several advantages relative to the time-domain synthesis technique. The primary advantage is that the frequency-domain method requires approximately ten times less computer time to synthesize the filter than does the time-domain technique. The details of a direct segment method for the spectral matrix estimation required in the frequency-domain approach are presented. In addition, the bias, variance, mean square error, limiting distribution, and other properties of the spectral estimates are discussed. The details of a Fortran IV computer program implementation of the frequency-domain method are given. The experimental results obtained by processing two events recorded at the large aperture seismic array are presented as well as a comparison of the performance of the frequency-domain method relative to the time domain synthesis technique. It is found that the processed noise power reduction for the frequency-domain method is typically about two out of a total of 20 db worse than that of the time-domain technique. Author (TAB)

N66-34274# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

THERMALLY ACTIVATED PROCESSES IN THE EARTH: CREEP AND SEISMIC ATTENUATION

R. B. Gordon Mar. 1966 26 p refs
(Contract Nonr-609(54))
(TR-2; AD-633710) CFSTI: HC $2.00/MF $0.50

Non-elastic behavior of crystalline material results from the thermally activated motion of crystal imperfections: perfect crystals are perfectly elastic. The mobility of crystal defects is determined by an activation energy, an activation volume, and an activation entropy, which to a good approximation are independent of temperature and pressure. Consequently the mobility of a crystal imperfection depends on depth in the earth in a characteristic way, increasing rapidly at first due to the steep thermal gradient near the surface and then decreasing due to the effect of pressure. Thermally activated movement of imperfections controls diffusion, phase tranformation kinetics, high temperature creep, recrystallization and the damping of elastic waves in solid mantle material. Diffusion creep, in which the motion of dislocations is not required, results from the diffusion of atoms in a stress gradient and produces viscous flow at geologically significant rates in a polycrystalline solid. The viscosity of the mantle resulting from diffusion creep passes through a minimum and is strongly depth dependent. A characteristic depth dependence of the damping of elastic waves is also found but the viscosity cannot be deduced from the observed internal friction. Author (TAB)

N66-34291 # Army Cold Regions Research and Engineering Lab., Hanover, N. H.

LIGHT SCATTERING AND PARTICLE AGGREGATION IN SNOWSTORMS

Malcolm Mellor Feb. 1966 23 p refs
(CRREL-RR-193; AD-633539) CFSTI: HC $1.00/MF $0.50

Attenuation of visible radiation by falling snow was studied by a method based on brightness contrast between topographic features and the adjacent sky. Extinction coefficient and visual range are related to snow density, and are compared with data for antarctic blizzards. Since attenuation depends more on the size and concentration of discrete particles than on the mass density of suspended snow, the process of particle aggregation and snowflake formation during fall is considered by collision theory, and an expression describing aggregation effects is developed. This offers an explanation for the relative constancy of particle concentration observed at ground level during snowfalls of varying intensity. Since there is no strong justification for relating extinction coefficient to snow density, an empirical correlation between extinction coefficient and precipitation rate is given for practical use. It is shown that visual range estimated by eye in hilly terrain may be less than the true value, since sky brightness is locally reduced over broad hilltops with low albedo. Author

N66-34312# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

[THE CHEMILUMINESCENT MEASUREMENT OF ATMOSPHERIC OZONE] Final Scientific Report, 5 Apr. 1962-31 Mar. 1966

31 Mar. 1966 31 p refs
(Contract AF 19(628)-417)
(AFCRL-66-246; AD-632562) CFSTI: HC $2.00/MF $0.50

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1. THE PREPARATION OF CHEMILUMINESCENT SUBSTANCE FOR THE MEASUREMENT OF ATMOSPHERIC OZONE V. H. Regener p 4-10 refs (See N66-34313 20-13)
2. THE PRODUCTION OF ACCURATELY KNOWN, VERY SMALL QUANTITIES OF OZONE IN AN AIR STREAM L. Zolotnitzky p 11-20 refs (See N66-34314 20-13)
3. NOTE ON OZONE MEASUREMENTS WITH THE CHEMILUMINESCENT SONDE V. H. Regener p 21-24 (See N66-34315 20-13)

N66-34313# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

THE PREPARATION OF CHEMILUMINESCENT SUBSTANCE FOR THE MEASUREMENT OF ATMOSPHERIC OZONE

Victor H. Regener *In its* The Chemiluminescent Meas. of Atmospheric Ozone 31 Mar. 1966 p 4-10 refs (See N66-34312 20-13) CFSTI: HC $2.00/MF $0.50

Preparation of a useful chemiluminescent material for measuring atmospheric ozone is extensively detailed. The basic substance, rhodamine B, is adsorbed on fine silica gel powder. Its stability for long-term storage in complete darkness, under moderate refrigeration, and in absolutely dry air is reported. R.Ll.

N66-34314# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

THE PRODUCTION OF ACCURATELY KNOWN, VERY SMALL QUANTITIES OF OZONE IN AN AIR STREAM

Leon Zolotnitzky *In its* [The Chemiluminescent Meas. of Atmospheric Ozone] 31 Mar. 1966 p 11-20 refs (See N66-34312 20-13) CFSTI: HC $2.00/MF $0.50

Equipment designed to furnish accurately known, very small partial densities of ozone in an air stream at atmospheric pressure is described. The equipment is used as a standard ozone source which makes possible the calibration of other ozone sources, and of ozone sensing devices operating at partial densities of ozone equal to those in the earth's atmosphere. The concentration of ozone produced by irradiating dry oxygen with ultraviolet light is determined by ultraviolet absorption measurement of 2537Å passing through a known thickness of the oxygen-ozone mixture. Ozone densities from 10 to 1000 gamma are obtained by diluting the concentrated oxygen-ozone mixture with dry air at a known rate to the oxygen-ozone flow. The calibration for a secondary standard, or generator, consists in comparing the ozone density at the output of the calibration system with that delivered by the generator to be calibrated. R.Ll.

N66-34315# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

NOTE ON OZONE MEASUREMENTS WITH THE CHEMILUMINESCENT SONDE

Victor H. Regener *In its* [The Cheminescent Meas. of Atmospheric Ozone] 31 Mar. 1966 9 21-24 (See N66-34312 20-13) CFSTI: HC $2.00/MF $0.50

Balloon measurements of ozone with the chemiluminescent sonde are reported This sonde can be assumed to measure directly the number of ozone molecules per unit volume (partial density) in terms of Q (micrograms per cubic meter, or gamma). In the formula presented, this term Q is also used for the Q in the outside air, provided that the pump, the reaction chamber, and the outside air are at the same temperature and pressure. Listed are factors affecting the efficiency of the chemiluminescent reation: dwell time of ozone in the chamber; ozone reaction rate independent of the air pressure at constant temperature; and, the ozone reaction rate with the chemiluminescent substance as a slow function of the temperature at constant pressure and constant partial density of ozone. Water vapor is mentioned as having a very definite adverse effect on the stability and reproducibility of the chemiluminescence of the substance. R.Ll.

N66-34351# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A MATHEMATICAL APPROXIMATION TO THE GEOMAGNETIC FIELD

Robert Earl Wiley (M.S. Thesis) Mar. 1966 101 p refs (GSP/PH/66-22; AD-633604) CFSTI: HC $3.00/MF $0.75

An attempt was made to form a mathematical model for calculating the geomagnetic field using fewer terms than presently used in spherical harmonic expansion models. The model was to be made up of pairs of magnetic monopoles. It was found that at least four pairs of monopoles would be needed to produce a satisfactory model. The initial data used for fitting the four pair of monopoles was the geomagnetic field as calculated by a spherical harmonic expansion using the Jensen and Cain coefficients. Emphasis was given to fitting the South Atlantic Anomaly. The root-mean-square error for this region was 1.3×10^{-2} Gauss while the overall root-mean-square error was 3.4×10^{-2} Gauss. Comparison of the errors of the monopole model with the errors of the Jensen and Cain coefficients indicates that the root-mean-square error for the monopole model is larger than that of the Jensen and Cain coefficients. Additionally, it was found that the monopole model calculations were only 1/3 faster than the spherical harmonic expansion instead of the desired 1/2 or more reduction in calculation time. Author (TAB)

N66-34445# Joint Publications Research Service, Washington, D. C.

TRANSLATIONS ON COMMUNIST CHINA: SCIENCE AND TECHNOLOGY, NO. 336. THE NON-ITERATIVE SOLUTION TO DIRECT GEODETIC PROBLEMS ON MEDIUM AND LONG DISTANCES

Chun-yung Ch'en 18 Aug. 1966 24 p refs Transl. into ENGLISH from Ts'e-Hui Hsueh-Pao (Peiping), v. 9, no. 2, Feb. 1966 p 87-99

(JPRS-37092; TT-66-33521) CFSTI: $1.00

Bessel's equation has been extended and improved in this paper. The reverse solution of trigonometric series has been used to eliminate the two kinds of equations in the direct successive approximation procedure. Also two other kinds of equations have been derived from high-accuracy (0".0001) and low-accuracy (0".01) practical equations. Tables of corresponding numbers have been compiled which are suitable for any reference ellipsoid. Finally, a rigorous equation (accurate to seventh-order terms of s) has been derived to solve direct geodetic problems of medium distances or low accuracy. Under these circumstances, many high-order terms of that equation can be neglected, thus computation can be facilitated. Author

N66-34521# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.

MODELING THE TUNGUS METEORITE EXPLOSION

I. T. Zotkin and M. A. Cikulin May 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 167, no. 1, 1966 p 59-62

(T-458-R; TT-66-61511; AD-634380) CFSTI: HC $1.00/MF $0.50

As a result of expeditionary operations from 1958 to 1965, a chart has been compiled of the stricken forest in the region of the Tungus meteorite fall, establishing the outline of the destruction region and the directions in which the trees were blown down at different points, over an area totalling 2200 sq km. The azimuths of about 40,000 tree trunks blown down on the 30th of June, 1908, have been determined by field studies. The character of the Tungus tree-fall leaves no doubt that it was produced by a powerful air wave with an energy of the order of 4×10^{23} ergs, the source of which was at some height above the earth. Author (TAB)

N66-34668# Office of Naval Intelligence, Washington, D. C.

THE RADIOOCEANOGRAPHIC INVESTIGATION OF SEA SWELLS [RADIO OKEANOGRAFICHESKIE ISSLEDOVANIYA MORSKOGO VOLNENIYA]

S. Ya. Braude, ed. [1962] 158 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR (Kiev), 1962

(ONI-Trans-2067, AD-634242) CFSTI: HC $5.00/MF $1.00

This symposium contains studies in which an attempt has been made to utilize the methods of modern radiophysics for investigating the processes of sea swells. The articles describe the apparatus used. The methods by which sea swells were studied, measurement data and the results of their analysis. This symposium is intended for radiophysicists and oceanographers working in the field of radiooceanography. Author (TAB)

N66-34589# Library of Congress, Washington, D. C. Aerospace Technology Div.

RESEARCH IN PHYSICS OF THE TERRESTRIAL ATMOSPHERE

Edward Gelins *In its* Foreign Sci. Bull., Vol. 2, No. 8 Aug. 1966 p 7–20 refs (See N66-34566 20-34)

Short abstracts of reports on the physics of various phenomena in the terrestrial atmosphere, dealing with the following topics, are presented: (1) ion and molecular interactions; (2) ozone influence on radiation exchange; (3) electron fluxes in the upper atmosphere; (4) positions of mirror points of high-energy electrons; (5) ionization and recombination in the ionosphere; (6) absorption of solar ultraviolet radiation in the upper atmosphere; (7) night sky emission into space; and (8) proton radiation belts. These works cover investigations of the whole atmosphere, including phenomena of the reflection of solar light on atmospheric molecules, the absorption of solar radiation, ionization processes, and the blackout of radio waves. Author

N66-34573# Library of Congress, Washington, D. C. Aerospace Technology Div.

EXPERIMENTAL INVESTIGATION OF ATMOSPHERIC TRANSMITTANCE AT WAVELENGTHS IN THE SUBMILLIMETER RANGE

In its Foreign Sci. Bull., Vol. 2, No. 8, Aug. 1966 p 31–33 refs (See N66-34566 20-34)

Radiation absorption measurements in the submillimeter region were made for transmittances at 0.2, 0.29, 0.36, 0.45, 0.73, and 0.87 mm from a mercury–quartz lamp mounted in the focal plane of a parabolic reflector. A spectrometer containing an optical-acoustical radiation indicator was used at the receiving end. The absorption coefficient was determined from the dependence of the received signal on humidity at varying distances between the radiation source and the receiver; obtained values were evaluated statistically by the method of least squares and compared to theoretically determined results. It was found that the measured values exceeded the theoretical results by a factor of 1.3 to 2. G.G.

N66-34585# Southwest Center for Advanced Studies, Dallas, Tex.

CYCLOTRON-RESONANCE AMPLIFICATION OF VLF AND ULF WHISTLERS

Harold B. Biemohn Jul. 1966 65 p refs Submitted for Publication

(Grant NSF GP-4339)

Electromagnetic signals which propagate through the magnetosphere exchange energy with nonthermal charged particles by the cyclotron–resonance mechanism. The interaction is due to a Doppler-shift of the propagation frequency ω to the cyclotron frequency ω_c of the charged particle which allows the particle to resonate with the electromagnetic fields. The dominant exchange is between electrons around 1 keV and VLF whistlers which propagate in the right-hand mode and between protons around 1 keV and ULF whistlers (Pcl geomagnetic micropulsations) which propagate in the left-hand mode. The complex wave number $k(\omega) = k_r + ik_i$ for propagation in a hot uniform plasma parallel to a static magnetic field is assumed to describe whistler properties locally in the magnetosphere. The power transfer function $A(\omega)$ which relates the input and output power spectrums is determined by the path integral of k_i along a geomagnetic flux tube. Spectrums of A for both VLF and ULF whistlers have been evaluated for a variety of energy and pitch angle distributions of the form $E^{-n} \sin^m \alpha$. Author

N66-34618# Denver Univ., Colo. Dept. of Physics.

HIGH ALTITUDE ATMOSPHERIC TRANSMITTANCE AS OBSERVED OVER NORTHERN CALIFORNIA Scientific Report No. 3

David G. Murcray, Frank H. Murcray, and Walter J. Williams May 1966 131 p ref

(Contract AF 19(628)-5202; ARPA Order 363)

(AFCRL-66-410; AD-635266) CFSTI: HC $1.50/MF $1.00

The solar spectrum from 3390 cm^{-1} to 4060 cm^{-1} as observed through the earth's atmosphere was measured during a balloon flight on September 30, 1965, at Chico, California. The atmospheric spectral transmittance for altitudes up to 31 km are presented both graphically and in a tabular form. The integrated absorption for each spectrum is also tabulated at 1/2 wavenumber intervals. The water vapor absorption measured at floating altitude is shown to increase proportional to $(\sec\beta)^{1/2}$ thus precluding significant absorption contributions from local outgassing. Assuming uniform mixing above 31 km, the mixing ratio for water vapor is 0.00005 g/g, consistent with earlier results. Author (TAB)

N66-34626*# National Engineering Science Co., Houston, Tex.

INVESTIGATION OF THE RELATION BETWEEN SOLAR VARIATIONS AND WEATHER ON EARTH AS SHOWN BY STUDY OF SIMULTANEOUS DATA FROM THE SUN, MARINER II, NEAR-EARTH SATELLITES AND THE ATMOSPHERE BELOW THE MESOSPHERE

John C. Freeman, Jr. and W. H. Portig Dec. 1965 129 p refs

(Contract NASw-724)

(NASA-CR-77306) CFSTI: HC $4.00/MF $1.00 CSCL 04A

A recognizable disturbance of a 10 mb chart is shown to accompany a solar disturbance. The 10 mb disturbance precedes the magnetic storm. An effect of increased organization of clouds as shown by TIROS photographs also accompanies the solar disturbance. The idea is promoted that energy is available from small scales at any level in the atmosphere to force planetary motions to follow the thermal wind equation. This idea releases students of solar influence from seeking energy for solar influence on the weather. Control rather than energy is required. With this new freedom a model of the atmosphere that allows control from above is developed. A similar model allows descending very long-period waves at the equator. Author

N66-34632*# Pittsburgh Univ., Pa. Space Research Coordination Center.

THE PROBLEM OF SODIUM DISTRIBUTION

T. M. Donahue 17 May 1966 15 p refs Presented at the COSPAR R-2 Symp., Vienna, 17 May 1966

(Contract NASr-179; Grants NsG-416; NSF GP-4435)

(NASA-CR-77299; SRCC-30) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Various methods of determining the quantity of free sodium atoms in the upper atmosphere are reviewed, and the results of several experimental studies are assessed. The differences between daytime and twilight sodium abundances are

examined, and the average day to twilight abundance ratio is shown for each semimonthly period from August 1961 to December 1965. Figures also depict the brightness of the D lines 7° above the horizon observed with a broad and narrow filter from a rocket, and D line brightness measured from a point above the sodium layer. Several assumptions for these variations are considered. The possibility of creating a thin aerosol layer in the mesopause is discussed in connection with the formation of noctilucent clouds. Experiments for elucidating the role of aerosols in the production of metallic atoms and ions in the E region are suggested. S.P.

N66-34662*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

ANISOTROPY OF REFLECTED SOLAR RADIATION FROM VARIOUS SURFACES AS MEASURED WITH AN AIRCRAFT-MOUNTED RADIOMETER

Vincent V. Salomonson Jun. 1966 38 p refs *Its* Rept.-2566-1

(Contract NASr-147)

(NASA-CR-77215) CFSTI: HC $2.00/MF $0.50 CSCL 04A

In the past few years, research has been done with satellite-mounted radiometers to determine terrestrial albedos and planetary heat balance. In these studies the reflection of the solar radiation was assumed to be independent of wavelength and isotropic. Using these assumptions, the satellite-determined values of planetary albedo have been found to be consistently low. In an effort toward resolving this discrepancy, the Nimbus medium resolution radiometer has been mounted on a Piper Twin Comanche and used to measure the anisotropy of reflected solar radiation from various surfaces. By flying over a surface using a prescribed flight pattern and the scanning characteristics of the radiometer, the variations in the reflected radiation in different directions, radiometer zenith angles, and solar zenith angles have been measured. The results show strong forward scattering over stratus clouds at a large solar zenith angle. Backscattering predominates over a grassland surface at a large solar zenith angle. The ratio of averaged observed reflectance to minimum observed reflectance varies from 1.09 to 1.40 depending on the bandpass and the reflecting surface. Author

N66-34673*# AVCO-Everett Research Lab., Everett, Mass.

UNSTABLE GROWTH OF UNDUCTED WHISTLERS PROPAGATING AT AN ANGLE TO THE GEOMAGNETIC FIELD

C. F. Kennel and R. M. Thorne May 1966 34 p refs Submitted for Publication

(Contracts NASw-837; Nonr-2524(00))

(NASA-CR-77341; AVCO Everett Res. Rept.-244) CFSTI: HC $2.00/MF $0.50 CSCL 04A

The local growth rate for whistler waves propagating at an angle to the geomagnetic field is combined with model ray path calculations to estimate the wave growth along the whistler path. This growth rate depends critically upon the equatorial plane distribution of electrons in the few hundreds of electron volt energy range. Under a variety of conditions apparently satisfied by the magnetosphere electron velocity distribution, a region of whistler growth near the equatorial plane exists and is sufficient to make a whistler mode unstable overall as it bounces back and forth across the equatorial plane between reflection points. Only unducted whistlers generated by resonant particle instabilities are treated. Author

N66-34676*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

ABUNDANCES OF Na, Sc, Cr, Mn, Fe, Co, AND Cu IN 92 METEORITES, 9 TERRESTRIAL SPECIMENS, AND 90 INDIVIDUAL CHONDRULES Quarterly Progress Report, 1 Sep.-30 Nov. 1965

R. A. Schmitt and R. H. Smith 17 Dec. 1965 45 p refs (Contract NASw-843)

(NASA-CR-77184; GA-4782) CFSTI: HC $2.00/MF $0.50 CSCL 08D

Using the technique of instrumental neutron activation analysis, abundances of sodium, scandium, chromium, manganese, iron, cobalt, and copper were determined in meteoritic specimens, terrestrial specimens, and individual chondrules separated from chondritic meteorites. Presented are tables and figures which contain abundance values of these elements in the H-group and L-group ordinary chondrites; comparative data on Na and Mn distributions in chondrules and the distribution of these elements in ordinary whole rock type chondrites; the average meteoritic and terrestrial abundances of Sc, Cr, Mn, Fe, Co, and Cu in the various meteorite classifications; the abundances of Sc, Cr, Mn, Fe, and Cu as a function of chondritic subclass and of H-group or L-group chondrites; abundances of Na, Sc, Cr, Mn, Fe, Co, and Cu as determined in individual chondrules and whole rock matrices of Allegan, Ochansk, Bjurbole, and Chainpur; and values for Fe in the presence of Co and Sc. Included is a discussion of experimentally derived abundance values for each element, and comments on theories concerning the origin of meteorites and chondrules. S.C.W.

N66-34772# RAND Corp., Santa Monica, Calif.

ABSORPTION MEASUREMENTS AT MORNING TWILIGHT

C. M. Crain Jun. 1966 15 p Presented at the DASA Symp. on the Phys. and Chem. of the Lower Atmosphere, Boulder, Colo., 28-29 Jun. 1966

(P-3397; AD-634830) CFSTI: HC $1.00/MF $0.50

This paper describes the variation of absorption produced by nuclear air bursts during the transition period from night to day. For air bursts occurring some 15 to 30 minutes before sunrise at 100 km, the transition absorption characteristics are found to have the following consistent features: (1) absorption increases from the nighttime value when the solar zenith angle reaches about 100 degrees; and (2) the transition from night to day occurs over a time period some 30 minutes longer than that calculated by a lumped parameter solution of the rate equations using only O_2^- negative ions and photodetachment. Data from three very similar bursts which occurred when the solar zenith angles were 96, 90, and 81 degrees are compared and are found to indicate the following characteristics: (1) the peak absorption reached at about 5 minutes following each of these similar bursts increased progressively with a decrease in the zenith angle at burst time; (2) the transient behavior for the 81-degree case was of a pure daytime nature, while the 90- and 96-degree cases indicated a night-day transition behavior, with the 96-degree case more marked in this regard. This feature is consistent with the results for the bursts occurring shortly before sunrise.

Author (TAB)

N66-34798*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

ON THE GRADIENT LINE OF THE EARTH'S ZONAL GRAVITATIONAL POTENTIAL

Walter Kohnlein 1 Jul. 1966 27 p refs

(Grant NsG-87)

(NASA-CR-77178; SAO Special Rept.-218) CFSTI: HC $2.00/MF $0.50 CSCL 08N

The shape of the gradient line of the earth's outer zonal gravitational potential is analyzed, and the distance (D) of the gradient line from its asymptote $|\Phi|$ is tabulated using both the Kozai and King–Hele zonal harmonic coefficients. Differences between these distances is hardly noticeable, except at lower elevations or near the equator. It is shown, however, that the Southern Hemisphere exhibits a stronger curved gradient line between the poles and asymptote $\approx 30°$ than does the Northern Hemisphere. From $|\Phi| \approx 20°$ on, there is a change toward the equator and D becomes larger in the Northern Hemisphere. Direction field and curvature are discussed, as is behavior of the gradient line around the equator. M.W.R.

N66-34872# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

THE NATURE OF THE NOVOTSARITSYNSKAYA GRAVITY ANOMALY IN THE LOWLANDS OF CRIMEA, ACCORDING TO THE DATA FROM THE SEISMIC TESTS [PRIRODA NOVOTSARITSYNSKOY GRAVITATSIONNOY ANOMALII V RAVNINNOM KRYMU PO DANNYM SEYSMICHESKIKH ISSLEDOVANIY]

V. B. Sollogubov, A. V. Chekunov, N. I. Pavlenkova, and L. A. Khilinskiy Apr. 1966 20 p refs Transl. into ENGLISH from Geofiz. Issled. Stroyeniya Zemnoy Kory (Kiev), issue 8, no. 10, 1964 p 3–12

(TC-999a; TT-66-61642; AD-634935) CFSTI: HC $1.00/MF $0.50

Seismic explorations, using a correlation method of refraction waves and deep seismic sounding, were undertaken to determine the nature of the geological structure of the area. A large number of different elastic waves, characteristic of the seismic surfaces of discontinuity at the depths of 35 km, was recorded. These were divided into the following groups: (1) waves from the seismic horizons in the sedimentary strata; (2) waves from the surface of foundation and from the boundary surface close to it; and (3) waves from the horizons inside the crystalline part of the earth's crust. Details are presented on each group. The interior structure of the earth's crust was found to be very complicated, with several seismic boundary surfaces and a deep-seated fault zone about 15 km wide filled with compact rocks of basic or ultrabasic composition which apparently produce the gravitational anomaly. N.E.N.

N66-34892# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

ANELASTIC PROPERTIES OF THE EARTH

Robert B. Gordon and Carl W. Nelson Apr. 1966 42 p (Contract Nonr-609(54))

(TR-3; AD-634286) CFSTI: HC $2.00/MF $0.50

Known mechanisms of internal friction in crystalline materials are examined to find which are likely sources of seismic attenuation in the earth's mantle. Presently available laboratory data on rocks are not useful for this purpose because of the low temperatures and pressures at which they have been determined but experiments on sintered oxides indicate the important damping mechanisms at high temperature. The sources of seismic attenuation in the order of their probable importance are viscous grain boundary damping, stress-induced ordering, and dislocation damping. If any parts of the mantle are partially melted, stress-induced flow of fluid through intergranular channels may also cause attenuation. These damping mechanisms characteristically result of internal friction showing a strong frequency dependence. Scattering is almost certainly not an important source of seismic attenuation. The variation with depth of internal friction due to a thermally activated relaxation mechanism is found and it is shown that such a source of internal friction can account for existing data on the anelasticity of the earth. The low attenuation observed at depths below about 500 km can result from the effect of pressure in decreasing atomic mobility; the observed attenuation decrease is therefore not in itself evidence of a phase change. The relation between damping and the strength of the mantle is developed and it is shown that seismic attenuation data do not put useful bounds on this quantity. Author (TAB)

N66-34911# Navy Electronics Lab., San Diego, Calif.

IONOSPHERIC VARIATIONS OVER WASHINGTON, D. C., BEFORE AND AFTER GEOMAGNETIC STORMS Research and Development Report, Jun. 1963–Jan. 1966

V. R. Noonkester 25 Mar. 1966 20 p refs

(NEL-1367; AD-634841) CFSTI: HC $1.00/MF $0.50

Midday averages of the critical frequencies of ordinary wave of the F_2- and E-regions, F_0F_2 and F_0E, and the minimum virtual height of the E-region, HE, were computed from hourly values to represent the E and F regions at Washington, D. C. Long-term variations were removed by mathematical filtering. Superposed epoch analysis of the filtered averages revealed that: (1) H and FE are not related to magnetic storms, (2) except during sunspot minimum, FF is large 1 or 2 days before magnetic storms and small up to 3 days afterwards, (3) during sunspot minimum FF is not related to magnetic storms. Author (TAB)

N66-34915# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

CERTAIN REGIONAL PROPERTIES OF THE ABYSSAL STRUCTURE OF THE EARTH'S CRUST IN THE TERRITORY OF THE USSR IN THE LIGHT OF GEOPHYSICAL DATA [NEKOTORYYE REGIONAL'NYYE OSOBENNOSTI GLUBINNOGO STROYENIYA ZEMNOY KORY TERRITORII SSSR V SVETE GEOFIZICHESKIKH DANNYKH]

E. E. Fotiadi, G. K. Karatayev, and I. S. Moiseyenko May 1966 25 p refs Transl. into ENGLISH from Geol. i Geofiz., Akad. Nauk SSSR, Sibirsk. Otd. (Novosibirsk), no. 10, 1965 p 12–22

(TC-1016; AD-633408) CFSTI: HC $2.00/MF $0.50

The results of correlation of large features of the earth crust stratification on the territory of the USSR obtained on the basis of interpretation of the complex of regional geophysical data with elements of pre-Neogene and post-Neogene tectonic structure are briefly discussed in the paper. It is found that the thickness of the earth crust as a whole and the thickness of basalt layer are clearly related to Neogene–Quarternary structure, and the thickness of granite layer furthermore reveals the connection with pre-Cenozoic structure and with the history of its development as well. The draft of density heterogenity with the upper mantle is discussed. Manifestation of isostasy for large territories are clearly evident. The authors insist on the fact that the processes of basification play an essential part in the development of the earth crust.

Author (TAB)

N66-34923# Naval Ordnance Lab., White Oak, Md. Physics Research Dept.

SPECIFIC VOLUME, THERMAL EXPANSION, AND ISOTHERMAL COMPRESSIBILITY OF SEA WATER

Wayne Wilson and David Bradley 2 Jun. 1966 52 p refs

(NOLTR-66-103; AD-635120) CFSTI: HC $1.50/MF $0.50

The specific volume has been measured for distilled-water and for five samples of sea water near salinities of 10, 20, 30, 35, and 40‰. These measurements were obtained for temperatures between 0°C and 40°C, and for pressure up to 14,000 psi. The Tumlirz equation of state has been fitted to the experimental data by the method of least squares. This equation

was then used to compute tables for the specific volume, the thermal expansion, and the isothermal compressibility over the full range of variables considered. This data is compared with that obtained from the works of other authors. TAB

N66-34951# Naval Oceanographic Office, Washington, D. C.
THE THICKNESS OF THE SEDIMENT LAYER AND THE STRUCTURE OF THE EARTH'S CRUST IN SEAS AND OCEANS ACCORDING TO THE RESULTS OF SEISMO-ACOUSTIC INVESTIGATIONS [MOSHCHNOST' OSADOCHNOGO POKROVA I STROYENIYE ZEMNOY KORY V MORYAKH I OKEANAKH PO REZUL'TA TAM SEYSMO-AKUSTICHESKIKH ISSLEDOVANIY]
G. B. Udintsev, Yu. P. Neprochnov, and V. M. Kovylin 1966 14 p refs Transl. into ENGLISH from Okeanologicheskiye Issled. (USSR), no. 13, 1965 p 181–188 *Its* Trans. No. 301 (AD-635063) CFSTI: HC $1.00/MF $0.50

During the IGY period the Institute of Oceanology of the USSR Academy of Sciences carried out seismoacoustic measurements in the seas and oceans. These measurements were done by the seismic reflection and refraction methods in the Pacific and Indian Oceans as well as in the Black, Japanese and Mediterranean Seas. New data were obtained on the structure of the earth's crust and sediments. Much similarity has been found between the earth's crust structure under the bottom of the Pacific and Indian Oceans and that of the enclosed and continental seas. The absence of the granite layer is common to all the above mentioned basins which differ from each other by the thickness of the sedimentary layer. Author (TAB)

N66-34955# Aeronautical Chart and Information Center, St. Louis, Mo. Chart Research Div.
APPLICATION OF FIRST APPROXIMATION FORMULAE FOR THE COMPUTATION OF CHARACTERISTICS OF THE EARTH'S GRAVITATIONAL FIELD [PRIMENENIYE FORMUL PERVOGO PRIBLEZHENIYA DLYA VYCHISLENIYA KHARAKTERISTIK GRAVITATSIONNOGO POLYA ZEMLI]
L. P. Pellinen May 1966 33 p refs Transl. into ENGLISH from Trudy Tsentral. Nauchn.-Isseldovatel. Inst. Geodezii, Aeros'yemki i Kartografii (Moscow), no. 157, 1965 p 85–100 (ACIC-TC-1025; TT-66-61647; AD-634930) CFSTI: HC $2.00/MF $0.50

The methods for numerical calculation of the earth's gravitational field characteristics are considered according to Molodensky's first approximation formulas. In the case where the mean values of gravity anomalies and G_1 corrections obtained for some areas can be used, it is recommended to determine the mean values of G_1 omitting the determination of their point values. When the radius of the averaging area is larger than 20km it is practical to use, instead of G_1 much smaller and more stable G' corrections (see formula 10). When free air anomalies are used, then the mean values of these corrections are close to the mean values of terrain reduction. The method is considered for the combined calculation of the mean values of Δg and G' from the data of the correlation analysis of the gravity anomalies and the heights of the earth's physical surface. It is recommended to eliminate the constant part from the anomalies when the effect of the nearest areas on the quasigeoidal heights and plumb-line is calculated. A rough evaluation of the mean values of the G_2 and G_3 corrections is made for large areas. Author (TAB)

N66-34980# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
MECHANICAL PROPERTIES OF CRUST AND MANTLE
E. Orowan Oct. 1965 43 p refs Submitted for Publication (D1-82-0485; AD-634878) CFSTI: HC $6.00/MF $0.50

A general discussion is given of the mechanical properties and the sharp elastic limits of crust and mantle. It is assumed that in single crystals, and in the grains of polycrystalline materials, the main source of viscous creep is the thermal removal of defects caused by plastic deformation. This leads to loss of strain hardening, and equilibrium with the applied stress is restored by additional strain replacing the thermally lost hardening ("recovery creep"). Areas discussed include the effect of temperature and pressure upon deformation, fracture, and the strength of the crust and mantle. C.T.C.

N66-34987*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC STORMS IN THE EARTH'S MAGNETIC TAIL
K. W. Behannon and Norman F. Ness Oct. 1965 98 p refs Submitted for Publication
(NASA-TM-X-57212; X-612-65-65-417) CFSTI: HC $3.00/MF $0.75 CSCL 08N

Detailed measurements of the earth's magnetic field at distances between 7 and 31.4 R_E were obtained by the IMP-1 satellite. The interaction of the solar wind with the geomagnetic field compresses it on the sunlit hemisphere but extends the field to form a magnetic tail in the antisolar direction with a median magnitude of 16 gammas. The satellite was imbedded well within the magnetic tail and for 19+ orbits (29–48) measured principally the temporal variation and spatial structure of this tail field. The experimental data reveal the development of a magnetically neutral sheet in the tail separating fields of opposite direction which are aligned parallel to the earth–sun line. A total of 5 magnetic storms were observed terrestrially which are correlated with satellite data and discussed in this paper. Three storms of an M-region sequence, presumed to be associated with the sector structure within the corotating interplanetary medium are presented and discussed in detail, as well as two other magnetic storms. Author

N66-35054# Boeing Scientific Research Labs., Seattle, Wash.
DILATANCY AND THE SEISMIC FOCAL MECHANISM
E. Orowan (MIT) Jan. 1966 25 p refs
(D1-82-0504; AD-634979) CFSTI: HC $1.00/MF $0.50

In a recent paper (Reviews of Geophysics 3:1965) F. C. Frank suggested that the seismic focal stress drop might be the consequence of a mechanical instability of deformation due to dilatancy of the crust and mantle. A more complete calculation shows that the instability attributed to dilatancy is a familiar general property of compacted granular masses independent of dilatancy. The rapid propagation of the seismic fault attributed to shear melting by elastic energy release would depend on the assumed absence of friction between the walls of an initial Griffith crack. Since the length of the thin Griffith crack was estimated at 5 km, friction could be absent only if the crack were filled with a pore fluid of pressure equal to the total pressure; in this case the shear strength would be zero and seismic shocks could not arise. Author (TAB)

N66-35088# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL OBSERVATION OF FLUCTUATIONS OF THE TEMPERATURE OF ATMOSPHERIC RADIO EMISSION
V. P. Lastochkin and K. S. Stankevich 20 Jan. 1966 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zanedenii. Radiofiz. (Gor'kiy), v. 7, no. 4, 1964 p 789–790
(FTD-TT-65-1468; AD-634112) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: Experimental observation of fluctuations of the temperature of atmospheric radio emission. Author (TAB)

N66-35102# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

THE EFFECT OF A LOW VISCOSITY LAYER ON CONVECTION IN THE MANTLE

J. Weertman May 1966 26 p refs

(CRREL-RR-203; AD-635158) CFSTI: HC $1.00/MF $0.50

If thermal convection occurs in the Earth's mantle, it may also occur within the Moon and Mars. The dimensions of these planets are comparable to the thickness of the Earth's mantle. Presumably the amount of radioactive heat generated per unit mass is similar in all three bodies. However, the surface morphology of the Earth differs markedly from that of the Moon or Mars. The explanation for the difference is based on the effect produced on convection in the mantle by the presence of a low viscosity or low creep strength layer. A low viscosity layer changes the amount of coupling between the outer crust and mantle convection. The theory assumes that the viscosity or creep strength is essentially zero in the low viscosity layer. The analysis is similar to that developed earlier for the calculation of stresses within the mantle. The deeper the low viscosity layer lies within the mantle, the greater is the coupling of the outer crust of the mantle convection currents. If the low creep strength layer lies close to the surface the outer crust is decoupled from the interior. According to the literature, the depth of the low velocity layer is determined by the temperature and pressure profiles within the mantle. Author (TAB)

N66-35106# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

ALBEDO AND SKY RADIANCE MEASUREMENTS IN GREENLAND

Fritz Kasten Apr. 1966 18 p refs

(CRREL-RR-180; AD-635376) CFSTI: HC $1.00/MF $0.50

This paper presents the results of measurements made in June 1961 on the ice sheet of northern Greenland. The following quantities were measured: total and visual albedo of the snow surface under overcast and blue skies as well as the corresponding albedos in several spectral ranges; vertical distributions of the luminance and of the radiance of densely overcast sky and snow surface in several spectral ranges; and azimuthal distributions of luminance and near-infrared radiance of skies of different densities. The interdependence of these quantities and their relationship to whiteout are discussed on the basis of the measurements. It is concluded that in order to fully or partly overcome whiteout, the luminance distribution must be made more or less nonuniform. This may be accomplished by cloud seeding, dark objects on the ground, or the use of light of other than visible wavelength. Author (TAB)

N66-35118# International Business Machines Corp., Cambridge, Mass. Space Systems Dept.

ATMOSPHERIC DENSITY DETERMINATION VIA NUMERICAL INTEGRATION AND DIFFERENTIAL ORBIT CORRECTION Scientific Report, Mar. 1965–Mar. 1966

Arnold S. Bramson Apr. 1966 44 p refs

(Contract AF 19(628)-4192)

(AFCRL-66-332; AD-634785) CFSTI: HC $2.00/MF $0.50

Atmospheric density determination may be carried out by a careful reduction of satellite observations over long periods of time. The particular approach being reported upon consists of a numerical integration procedure combined with a differential correction scheme where discrepancies between computed and observed satellite position and velocity are reconciled by adjusting the assumed atmospheric model, thereby yielding corrected or refined density data. An important advantage of this technique is its applicability to satellites entering the decay stage where the effects of atmospheric drag are considerable and where a relatively short time span of observations may be available. This report describes a computer program which is capable of computing atmospheric densities. Emphasis is placed on the actual use of the program, with a complete user's manual being included. Preliminary numerical results obtained from the program are presented and limitations of the method are discussed. Author (TAB)

N66-35162# National Bureau of Standards, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.

THE SEASONAL VARIATION OF NIGHTGLOW NAI 5890-96A, (OI) 5577 A AND (OI) 6300 A IN THE TROPICS

L. L. Smith and R. W. Owen 10 Jan. 1966 53 p refs

(NBS-TN-329) GPO: $0.35

A study is presented of one year (July 1961–July 1962) of systematic zenith observations of the nightglow emissions [OI] 5577A, [OI] 6300A, and NaI 5890-96A at the Haleakala Observatory (latitude N 20.7°). Observed seasonal variations are shown and compared with previous investigations.

Author

N66-35182*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.

TESTS OF SATELLITE DETERMINATIONS OF THE GRAVITY FIELD AGAINST GRAVIMETRY AND THEIR COMBINATION

W. M. Kaula [1966] 34 p refs *Its* Publ.-508

(Grant NsG-216)

(NASA-CR-77494) CFSTI: HC $1.00/MF $0.50 CSCL 08N

Six solutions for the variations of the geopotential from satellite orbit analysis were compared to terrestrial gravimetry in the form of mean free air anomalies of 300 n. mi. squares. Statistical parameters calculated were the mean square values of each type as well as the mean square difference for different samples based on the number of observations in the 300 n. mi. square. The study showed significant variation in quality between different solutions, the best being that recently obtained from camera tracking of satellites by Gaposhkin. It also showed that the arithmetic mean of four independent satellite solutions was better than any single solution. This combined satellite solution was used in an adjustment with the gravimetry to obtain a single best solution, given herein in the forms of a geoid map; spherical harmonic coefficients to degree and order 12,12; and gravity anomalies at 10° intervals. Author

N66-35198# Joint Publications Research Service, Washington, D. C.

HIGH-LEVEL MESOVORTEX AND SOME OF ITS CHARACTERISTICS

L. S. Minina 29 Aug. 1966 20 p Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, 1966 p 21-30

(JPRS-37281; TT-66-33710) CFSTI: $1.00

The observation and detection, formulation, and nature of the mesovortex are discussed. Two specific cases are described which were photographed by the meteorological satellite Tiros 7. The meteorological maps of the periods before and at the time of the photographs are analyzed, and the details on wind velocity, altitude, cloud formation, jet

stream, and wind fields are presented. The data show that a high level mesovortex is a cyclone region of limited extent but differing from a cyclone in size and formation. It is suggested that with the disappearance of a source of vortical movements a cloud vortex can exist for some time. N.E.N.

N66-36203# National Bureau of Standards, Boulder, Colo.
NUMERICAL SIMULATION OF IONOSPHERIC WAVE INTERACTION EXPERIMENTS
Thomas M. Georges 25 Oct. 1965 52 p refs
(NBS-TN-325) GPO: $0.30

The Fejer pulse interaction experiment is simulated numerically by solving, in an iterative fashion, the electron energy balance and magnetoionic propagation equations over a height–time matrix representing a disturbed ionosphere. The complex interdependence of physical variables is more accurately represented by including "self-distortion" effects on the disturbing pulse, and allowing electron collision frequency and the energy loss coefficient G to vary with electron energy and time. Provision is made for nonrectangular disturbing pulses as well as finite-length probing pulses. Phase as well as amplitude interaction effects are calculated. Absorption and phase shift computations are based on the Appleton–Hartree or Sen–Wyller complete (arbitrary angle of propagation) formulations. Representative calculations demonstrate the effects of variations in experimental parameters, perturbations of ionospheric conditions, and various interpretational assumptions. Author

N66-36289# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBERG, URI-CODE 131, APRIL–JUNE 1965 [IONOSPHAREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, APRIL–JUNI 1965]
[1965] 128 p In GERMAN and ENGLISH
(Rept.-226F; Rept.-227F; Rept.-228F) CFSTI: HC $4.00/MF $1.00

Presented are the ionospheric data obtained by a research institute in Freiburg, Germany, during the period of April through June, 1965. Critical echo wave frequencies for the F_2-, F_1-, and the E-layer were observed as well as frequencies in transient stratifications, ordinary wave frequencies, lowest usable frequencies, etc. G.G.

N66-36293# Weapons Research Establishment, Salisbury (Australia).
TEMPERATURE CORRECTIONS TO A BEAD THERMISTOR IN THE UPPER ATMOSPHERE
A. D. Hind May 1966 36 p refs
(WRE-PAD-121) CFSTI: HC $2.00/MF $0.50

An investigation has been made into the temperature corrections to be applied to a bead thermistor which is used to measure temperature in the 200,000 ft region of the atmosphere. The corrections applied to a temperature profile obtained from a Dropsonde firing at Woomera on 22nd March 1966 are shown in detail. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-34147# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TIME RESOLVED SPECTROSCOPY OF EXPLODING WIRES
Roger Salisbury Case, Jr. (M.S. Thesis) Mar. 1966 108 p refs
(GSP/PH/66-2; AD-633651) CFSTI: HC $4.00/MF $0.75

The paper reports the design, construction, and calibration of a time resolving spectrograph camera system which was used to study the temperature and opacity as functions of time in plasmas produced by exploding wires of five elements (Ag, Au, Al, Cu, and Ni. The differences in the spectra produced by wires exploded in a vacuum environment and those exploded at atmospheric pressure were also studied. Photographs of the spectra produced by copper wires exploded both in air and in a vacuum environment, and photographs of the system components are included. The recording time at 3000 rps for this instrument was .26 μsec. The reciprocal dispersion of the spectrograph and camera was 34.7 Å mm. The system was astigmatic. Author (TAB)

N66-34151# Naval Research Lab., Washington, D. C. Space Surveillance Branch.
TRANSISTORIZED DIGITAL CLOCK WITH SERIAL BINARY-CODED READOUT Interim Report
L. O. Hayden 10 May 1966 20 p refs
(NRL-6389; AD-633695) CFSTI: HC $1.00/MF $0.50

A transistorized digital clock and coder unit has been developed which is being used as part of the time standard equipment at the U. S. Naval Space Surveillance Stations in Hawkinsville, Georgia, Red River, Arkansas, and Raymondville, Texas, which were instrumented in 1965. This unit is powered by a 24-V battery supply and is capable of 24 hours of emergency service in case of commercial power failure. Decimal digits are read out in binary format at a rate of one decimal digit per second. Each group of pulses comprising a decimal digit is clearly separated from the next pulse group. Once the code is learned, it is much easier to recognize than the one formerly used in the space surveillance system. The transistorized circuitry used in this unit has resulted in a considerable reduction in size and power input (12 W) as compared with the vacuum tube unit which has been used for a similar purpose in other space surveillance stations. Also, the error in coding due to aging of components has been eliminated since only two levels must be distinguished in the binary logic as compared with the ten voltage levels of the decimal logic in the earlier equipment. The new unit employs two cascaded gates, one switching at 0.1-sec intervals and the other at 1.0-sec intervals. Author (TAB)

N66-34204# Santa Barbara Research Center, Goleta, Calif.
PRODUCTION ENGINEERING MEASURE, PbSe INFRARED DETECTOR, TYPE IR-200, VOLUME 2 Final Engineering Report, 1 Jan. 1963–31 Aug. 1965
F. Murray 10 Nov. 1965 178 p refs
(Contract DA-36-039-AMC-01466(K))
(AD-624208) CFSTI: HC $5.00/MF $1.00

The manufacturing procedures established for the fabricating, cleansing, testing, assembling, and shipping of components and detector are presented. The inspection procedures of the quality control department are described. N.E.N.

N66-34226# Army Foreign Science and Technology Center, Washington, D. C.
EXHIBITION OF CONTEMPORARY GEODETIC AND PHOTOGRAMMETRIC INSTRUMENTS
S. P. Shokin Jun. 1966 21 p Transl. into ENGLISH from Geodez. i. Kartograf. (Moscow), Dec. 1965 p 3–17
(FSTC-HT-23-93-66; TT-66-61500; AD-634284) CFSTI: HC $1.00/MF $0.50

One hundred and twenty geodetic and photogrammetric instruments developed in the USSR, Bulgaria, Hungary, and East Germany in 1962–1965 were exhibited at Moscow from 15 September to 5 October 1965. The exhibits included aerial cameras, instruments for processing aerial photographs and compiling maps from aerial photographic surveys, gravimetric instruments, and instruments for measuring angles, distances, and relative altitudes on the earth's surface. Descriptions and illustrations of a number of these instruments are given. Author (TAB)

N66-34228# Navy Underwater Sound Lab., New London, Conn.
EVALUATION OF LOW-FREQUENCY, BROAD-BAND, FREE-FLOODING MAGNETOSTRICTIVE SCROLL TRANSDUCERS
Theodore J. Meyers 14 Jun. 1966 16 p refs
(USL-754; AD-634249) CFSTI: HC $1.00/MF $0.50

The report presents the experimental results of the evaluation of low-frequency, broad-band, free-flooding magnetostrictive scroll transducers, the design of which is based upon previous work done with high-frequency models. The bandwidth of free-flooding magnetostrictive scroll transducers may be increased by properly coupling (or staggering) the cavity and mechanical ring resonant frequencies of the transducer. It is possible to achieve a usable bandwidth of about one octave; however, the broad-band scrolls have greater weight and lower peak efficiency than do the narrow-band scrolls. In spite of their greater weight, free-flooding magnetostrictive scroll transducers have advantages over other types of transducers in that they are rugged, reliable, and easily constructed; they should be highly resistant to damage from explosive shock; and they are insensitive to hydrostatic pressure. In some applications, the advantages of free-flooding magnetostrictive scroll transducers may far outweigh their disadvantages. Author (TAB)

N66-34266# Office of Naval Intelligence, Washington, D. C.
FABRY-PEROT INTERFEROMETER IN THE MICROWAVE REGION OF THE SPECTRUM AND ITS USE FOR PLASMA DIAGNOSTICS [INTERFEROMETR FABRI-PERO MIKROVOLNOVOY OBLASTI SPEKTRA I EGO PRIMENENIYE DLYA DIAGNOSTIKI PLAZMY]
[1966] 12 p Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 3, no. 4, 1965 p 311–319 *Its* Transl. No. 2198 (TT-66-61472; AD-634229) CFSTI: HC $1.00/MF $0.50

Investigations were made of the resolving power and transmissivity of a Fabry–Perot interferometer in the microwave region of the spectrum. The possibilities for using this instrument for plasma diagnostics are shown. TAB

N66-34288# American Science and Engineering, Inc., Cambridge, Mass.
INSTRUMENTATION TO MEASURE THE RATE OF ION PRODUCTION IN THE UPPER ATMOSPHERE DURING AN AURORA Final Report, 15 May–14 Nov. 1965
Edwin R. Hegblom, William P. Reidy, and Clifton Doiron 22 Apr. 1966 75 p refs
(Contract AF 19(628)-5178)
(ASE-1244; AFCRL-66-301) CFSTI: HC $3.00/MF $0.75

An ion chamber designed to measure the rate of ionization in the upper atmosphere during an aurora is described. The details of the instrument's design, operation, and calibration are presented. The flights of two ion chambers on two Astrobee 200 rockets launched from Fort Churchill, Manitoba, Canada, in January 1966 are described in detail. Author (TAB)

N66-34278# Geophysics Corp. of America, Bedford, Mass. Technology Div.
HIGH ALTITUDE GUN PROBES (DEVELOPMENT OF LANGMUIR PROBES) Final Report
A. V. Block, A. L. Kadis, and L. C. Smith Sep. 1965 68 p refs
(Contract DA-19-020-AMC-00292(R))
(GCA-TR-65-15-G; AD-633920) CFSTI: HC $3.00/MF $0.50

This final report describes a program to develop an instrument capable of measuring electron density in the 50 to 160 kilometer altitude region and capable of surviving a 60,000 G shock encountered during launch from a cannon. This report is in two parts: the first describes various techniques and instruments capable of measuring electron density in this altitude region. The second section describes the design techniques as well as flight results from these probes. Both dc and ac Langmuir probes were chosen as the best instruments for fulfilling the system requirements. Author (TAB)

N66-34297# Royal Aircraft Establishment, Farnborough (England).
A MULTI-LEVEL COUNTING EQUIPMENT FOR ANALYSING ELECTRICAL SIGNALS
T. D. Reed Dec. 1965 36 p refs
(RAE-TR-65297; AD-634290) CFSTI: HC $2.00/MF $0.50

This equipment is suitable for the analysis of random analogue data. Twenty amplitude levels may be pre-set about the mean level of the input signal and the crossings of these threshold levels are counted. In addition the amplitude probability distribution of the signal can be measured. Some measurements of a pseudo-random signal, obtained by low-pass filtering of a digital code are described. Author (TAB)

N66-34325*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MANUFACTURE OF LITHIUM-DRIFTED SILICON SURFACE-BARRIER SEMICONDUCTOR COUNTERS
Norton Baron and Gerald A. Kaminski Washington, NASA, Aug. 1966 24 p refs
(NASA-TN-D-3554) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Monocrystalline silicon specifications are evaluated for feasibility of manufacture into surface-barrier semiconductor counters. The manufacturing process is described, and details are given on: the diffusion of lithium into silicon wafers, etching and polishing of wafer surfaces, determination of diffusion depth, measurement of wafer diode characteristics, electrical contacting of front surfaces, ohmic contacting of back surfaces, and wafer insertion as a semiconductor counter into the mount. Counter size manufactured varies in compensated depth from 1000 to 7000 microns and in diameter from 1.0 to 1.5 centimeters. Cooled to dry-ice temperature, counter resolution is typically between 15 and 25 keV for 6-MeV alpha particles. Graphs show the typical response of these detectors to monoenergetic charged particles; there is no high-energy tail, and the low-energy tail is not severe. When magnetic analysis is used for the reaction product particles, accelerator scattering systems capable of 10-keV resolution work could achieve better than 25 keV over-all resolution by using these counters. R.U.

N66-34348*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH AND DEVELOPMENT IN INSTRUMENTATION FOR STATIC TESTING
Albert E. Schuler *In its* Ground Testing at MSFC 1965 p 15–27 (See N66-34346 20-23) CFSTI: HC $2.00/MF $0.50

The research and development programs in instrumentation for static testing are summarized in this report. The work is described under the categories of cryogenic fuel density measurements, mass flowmeters, liquid-level sensors, temperature-measuring instrumentation, damped accelerometers, digital transducers, and calibration systems. Author

N66-34426*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHARACTERISTICS OF A NEW TYPE BALANCE FOR WIND-TUNNEL MODELS

John Dimeff, Keith Mc Farland, Inder N. Chabra, and Edward L. Conley Washington, NASA, Aug. 1966 25 p

(NASA-TM-X-1278) CFSTI: HC $1.00/MF $0.50 CSCL 14B

An internal-sting, six-component, strain-gauge balance has been developed and calibrated. The balance is used to measure the aerodynamic forces on wind tunnel test models. A unique feature of the balance is a hollow cavity running the length of the balance, through which additional wires, linkages, and hydraulic lines can be passed. Other attractive features include the ease of aligning the force elements, and the ability to fabricate the assembly with standard machine shop tooling. These features are made possible by the relatively simple geometry with all elements being machined in one piece. The performance of the balance was felt to be comparable to that of the best commercial balances available. Author

N66-34428*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CHARACTERISTICS, SELECTION AND USE OF RESIDUAL GAS ANALYZERS

William W. Hultzman Washington, NASA, Aug. 1964 14 p

(NASA-TM-X-1281) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Some of the more important characteristics of residual gas analyzers utilizing the mass spectrometer principle of operation are described. Discussion of many of the commercial models now available is based on actual evaluation of, or experience with, instruments currently in use, as well as on manufacturers' published literature. The selection and use of a residual gas analyzer are discussed by considering such performance factors as sensitivity, minimum detectable pressure, mass range coverage, resolution, and mass spectra scan time. Also discussed are operating features including reliability, flexibility, convenience, and analyzer tube envelope construction. Author

N66-34534# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.

A NEW TYPE OF LOW-RESOLUTION MASS SPECTROMETER

I. E. Dayton, J. M. Saari, and R. I. Schoen Mar. 1966 37 p refs

(D1-82-0508; AD-634235) CFSTI: HC $2.00/MF $0.50

A pulsed, low-resolution, slitless mass spectrometer of a new type is discussed. Mass analysis is achieved by scanning the energies of ions which have been given equal momentum increments. The chief advantage of the design lies in the large ionization volume available. The possibility of using this kind of mass spectrometer for photoionization, ion–molecule reaction and energetic ion studies is pointed out. Mass spectra obtained by electron ionization and photoionization are presented. Resolution of at least one mass unit in 15 is demonstrated and a sensitivity of 3 amp/(amp torr) for electron ionization in nitrogen is shown. Author (TAB)

N66-34591# Royal Aircraft Establishment, Farnborough (England).

LOW RESOLUTION LENGTH MEASUREMENT BY A SIMPLE DIGITAL METHOD

H. W. P. Knapp Dec. 1965 19 p refs

(RAE-TR-65267; AD-634218) CFSTI: HC $1.00/MF $0.50

A photodiode controlled digital encoder giving a low resolution measurement of length is described. The principle is demonstrated by considering the design of gray, binary and binary-coded-decimal encoders. Author (TAB)

N66-34600# Frankford Arsenal, Philadelphia, Pa. Pitman–Dunn Research Labs.

SCHLIEREN STUDIES OF ULTRASONIC TRANSDUCERS

James R. Kymer Jun. 1966 9 p

(T66-8-1; AD-635471) CFSTI: HC $1.00/MF $0.50

Several ultrasonic transducers (used in the inspection of shell bodies) were examined by the Schlieren technique to determine the homogeneity of the radiated field. For 11 of the 15 transducers examined, the field was nonhomogeneous. Author (TAB)

N66-34743# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

SILICON SURFACE-BARRIER DETECTORS FOR ALPHA RADIATION DOSIMETRY

J. Roman, B. Bukowiecki (Central Lab. for Radiological Protection), and J. Chwaszczewska 1965 29 p refs

(CLOR/IBJ-II-37/D)

Applications of gold–silicon surface-barrier detectors to routine alpha radiation dosimetry are discussed. The performance of the detectors is discussed. NSA

N66-34747# Joint Inst. of Nuclear Research, Dubna (USSR). Lab. of High Energy.

ANALOGUE WIRE SPARK CHAMBER SYSTEM FOR MEASUREMENTS OF PARTICLE MOMENTA AND ANGLES

L. A. Golutvin, Yu. V. Zanevsky, B. A. Kulakov, and E. N. Tsyganov 18 Sep. 1965 18 p refs Submitted for Publication

(JINR-E-2366)

A four-spark-chamber array, for rapid measurements of particle momenta, is constructed and tested. The system has ferrite cores and provides an analog recording of information. The time during which information can be obtained is less than 1 μsec. The output signal is the value of the angle of the particle deflection in the magnetic field. The accuracy of measurement of the particle deflection angle at a distance of 1 m between a pair of the chambers is ±2 mrad. Systems of similar types can be applied to solving various physical problems, e.g., elastic scattering, search for new resonances, etc. They can also be used for triggering more complicated spark chamber arrays. Author (NSA)

N66-34750# Princeton-Pennsylvania Accelerator, Princeton, N. J.

A K^+ DETECTOR FOR USE WITH A RAPID CYCLING BUBBLE CHAMBER

Harold Sanders 6 Dec. 1965 25 p refs Presented at 12th Nucl. Sci. Symp. of the IEEE, San Francisco, 18–20 Oct. 1965

(Contract AT(30-1)-2137)

(PPAD-574E) CFSTI: HC $1.00/MF $0.50

A detector system was constructed to detect the decay of K^+ particles generated in nuclear events in the twenty cycles per second hydrogen bubble chamber at the Princeton-Pennsylvania Accelerator. The purpose of this system is to preview each event to minimize the number of non-productive photographs. Ninety-six large plastic scintillator counters form an array covering 180° of the downstream side of the chamber. Particle discrimination is done by generating a clock

timing pulse from counters placed in the incoming beam which enables a set of coincidence gates driven by individual array counters, in such a period as to exclude outputs due to various prompt particles (i.e., the primary beam or the results of various elastic interactions in the chamber). A second level of gating is required to determine if the interaction has occurred during a period in which the chamber was sensitive. The output signal is used to trigger a chamber illuminating flash tube to photograph the event. Author (NSA)

N66-34755# Princeton-Pennsylvania Accelerator, Princeton, N. J.

GUIDE LINE FOR USE OF STANDARD NUCLEAR INSTRUMENT MODULES

R. C. Bissell and T. F. Droege 15 Feb. 1966 21 p refs
(Contract AT(30-1)-2137)
(PPAD-584D) CFSTI: HC $1.00/MF $0.50

A user's manual which contains most of the drawings, standards and pin assignments that are needed to make effective use of the nuclear instrument module system is presented. NSA

N66-34756# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorbauelemente.

A DISTRIBUTION SYSTEM FOR A MULTI-CHANNEL PULSE-HEIGHT ANALYSER [EIN AUSGABESYSTEM FUER EINEN VIELKANAL-IMPULSHOEHEN-ANALYSATOR]

May 1965 21 p In GERMAN
(JUL-270-RB)

A distribution system is built for an RCL 512-channel analyzer. The system permits the data stored in the multichannel analyzer to be distributed to a tape punch or to an IBM typewriter. The decoding of the channel number and the channel number preselection, and the control of the typewriter and of the tape punch are given. The operation of the counter is outlined. As an example of the use of the distribution system, the stability of the total amplification factor of a γ spectrometer (and, therefore, the position constant of a γ peak) is studied with respect to the change of the multiplier voltage with and without use of an SES stabilizer. NSA

N66-34758# European Co. for the Chemical Processing of Irradiated Fuels, Mol (Belgium).

ELECTRODELESS CONDUCTIVITY METER FOR ON-STREAM MEASUREMENTS

M. De Carolis and A. Mongon Aug. 1965 22 p refs
(NP-15756; ETR-175) CFSTI: HC $1.00/MF $0.50

An instrument developed for the measurement of the conductivity of the feed solutions of the first extraction cycle of the Eurochemic Reprocessing Plant is described. The instrument can be used to measure conductivities in the range from 0.15 to 0.80 mho-cm^{-1} at temperatures from 20 to 38°C. NSA

N66-34780# Army Nuclear Defense Lab., Edgewood Arsenal, Md.

DEVELOPMENT, TESTING AND EVALUATION OF GERMANIUM NUCLEAR PARTICLE DETECTORS

H. S. Katzenstein and F. P. Ziemba Jun. 1966 110 p refs
(Contract DA-18-108-AMC-142(A))
(NDL-TR-76; AD-634718) CFSTI: HC $4.00/MF $0.75

Results are presented of a study of some of the properties of thin-window germanium nuclear-particle detectors which were fabricated by use of the surface barrier lithium-ion-drift techniques. Emphasis was placed on the development of germanium-particle detectors that were suitable for application in the neutron spectrometer which employs the Li^6 sandwich technique. The study resulted in: (1) a fabrication procedure for the production of these devices, (2) a preamplifier for germanium detectors, (3) a cooling system for the germanium detectors, (4) an improved electronic system, utilizing nanosecond electronics, for the Li^6 spectrometer, (5) some general comparisons between silicon and germanium detectors, (6) qualitative information on the fast-neutron-induced reaction in silicon and germanium and (7) preliminary data on the response of a neutron spectrometer using thin-window silicon and germanium nuclear-particle detectors. Author (TAB)

N66-34800*# Illinois Univ., Urbana. Coordinated Science Lab.

THEORETICAL AND EXPERIMENTAL STUDIES OF THE UNDERLYING PROCESSES AND TECHNIQUES OF LOW PRESSURE MEASUREMENTS Semiannual Status Report, 1 Dec. 1965–30 May 1966

R. N. Peacock et al Aug. 1966 9 p refs
(Grant NsG-376)
(NASA-CR-77333) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Progress is reported related to improving the low pressure characteristics of the Schuemann suppressor gauge, and the vacuum work necessary to accomplish this. Problems with the gauge are associated with outgassing the electrode structure to permit operations at pressures as low as 10^{-12} Torr, the mechanical structure of the electrodes, and the Barkhausen oscillations. Efforts to reach lower pressures are discussed for the presently-used glass systems, as well as for metal systems. A steel system designed for comparing ionization gauges is in preparation, and initial results have attained pressures as low as 8×10^{-11} Torr. This system is being outfitted with a well-trapped diffusion pump to maintain low pressures during bakeout, thereby reducing saturation of the metal by the gases present. Adsorption of gases at metal surfaces is being studies by the auger process. M.W.R.

N66-34814# Utah State Univ., Logan. Electro-Dynamics Labs.

A CONTINUOUSLY VARIABLE DOUBLE SLIT SYSTEM AND THE FOURIER ANALYSIS OF MICHELSON'S STELLAR INTERFEROMETER Scientific Report No. 5

Royce H. Allen 1 May 1966 70 p refs
(Contract AF 19(628)-3825; ARPA Order 450)
(AFCRL-66-399; AD-635263) CFSTI: HC $1.50/MF $0.75

An experimental investigation was made to develop a procedure whereby the Michelson stellar interferometer could be used to space analyze an unknown quasi-monochromatic source function under Fraunhofer conditions. A continuously variable double slit system is described in detail which separates a pair of infinite parallel slits in a uniform bilateral fashion. The techniques involved in the retrieval of information from the interference pattern of the interferometer are shown to be: (1) place a fixed detector in the region of the first order of the diffraction curve, (b) allow the double slits in the interferometer to separate at a uniform rate, (c) obtain the visibility curve by determining the envelope of the intensity versus slit separation distance curve from the previous step, and (d) Fourier transform the visibility curve to obtain the source function. Author (TAB)

N66-34878# Office of Naval Intelligence, Washington, D. C. Translation Section.

A NUCLEAR PRECESSION MAGNETOMETER WITH COMBINED PROCESSES OF POLARIZATION AND METERING

A. I. Filatov, A. P. Stepanov, and V. M. Stotskii [1965] 10 p refs Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 1, 1965 p 169–173
(ONI-TRANS-2070; TT-66-61432; AD-633896) CFSTI: HC $1.00/MF $0.50

The article describes a method of measuring the earth's magnetic field. The method is based on a free nuclear precession which takes place during a continuous dynamic polarization of protons of an aqueous solution of potassium nitrodisulfonate $K_2[NO(SO_3)_2]$. The precession of the nuclear magnetization begins after the latter has rotated by an angle of $\sim\pi/2$ in relation to the field to be measured. This rotation can be effected by a sharp impulse from an auxiliary magnetic field. Given are experimental results obtained by a study on a laboratory model which provided two readings per second. Author (TAB)

N66-34895# Army Foreign Science and Technology Center, Washington, D. C.
ON THE RESULTS OF THE NINTH ALL-UNION CONFERENCE ON AERIAL SURVEYS
P. Ya. Rayzer Jun. 1966 13 p Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 11, Nov. 1965 p 3–8
(FSTC-HT-23-84-66; AD-634285) CFSTI: HC $1.00/MF $0.50

The Ninth All-Union Conference on Aerial Surveys was held at Leningrad in March 1965 under the auspices of the Interdepartmental Commission on Aerial Surveys of the Academy of Sciences USSR. More than 700 delegates attended, and 160 papers and communications were read at the section sessions and 18 papers at the plenary sessions. The sections were seven in number: aerial surveying and photogrammetry, geographical surveys, geological surveys, geophysical surveys, soils and geobotanical surveys, engineering geology, and engineering surveys. Only some of the most interesting papers on aerial photography and photogrammetry are discussed. Author (TAB)

N66-34901# Mitre Corp., Bedford, Mass.
MICROWAVE PORTION OF THE OXYGEN LINES REFRACTOMETER
Raymond J. Snay Bedford, Mass., AFSC, Electron. Systems Div., Jun. 1966 41 p refs
(Contract AF 19(628)-5165)
(MTR-18; ESD-TR-66-65; AD-635048) CFSTI: HC $2.00/MF $0.50

A microwave subsystem was installed in the Mitre Corporation's refractometer vans as an integral part of the oxygen-lines refractometer. In operation, two coherent frequencies, 45 and 90 Gc, are transmitted along a 23-km path, and the change in differential phase shift is measured at the receiver. This change is an indication of the refractive qualities of the atmosphere over the path. The equipment was tested at a field site in the Lake Winnepesaukee, New Hampshire, region; test results and recommendations for improving system sensitivity and stability are given. Author (TAB)

N66-34908# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN, CONSTRUCTION AND TESTING OF A MOSSBAUER SPECTROMETER
Patrick J. O'Toole (M.S. Thesis) Jun. 1966 104 p refs
(GSP/PH/66-14; AD-635040) CFSTI: HC $4.00/MF $0.75

The purpose of this project was the construction and testing of an electromechanical Mossbauer spectrometer with constant acceleration mode of operation. Design of the spectrometer is based on the original plan of the National Bureau of Standards. The spectrometer is designed for use in both research and education. Velocity calibration of the spectrometer was obtained by use of a voltage-to-frequency converter, a multichannel analyzer and an Fe^{57} absorption spectrum. In the range checked, the linearity of the system is 0.10%. Sample results obtained from Fe^{57} source-absorber combinations are presented. The results indicate agreement to within ±5% of values in the literature. Author (TAB)

N66-34914# CBS Labs., Stamford, Conn.
SPECIAL XUV DETECTORS FOR PHOTOELECTRON EMISSION STUDIES Final Report, 1 Feb. 1963–31 Mar. 1966
C. E. F. Misso and S. Trotta 30 Apr. 1966 70 p refs
(Contract AF 19(628)-2483; ARPA Order 213)
(AFCRL-66-353; AD-634789) CFSTI: HC $3.00/MF $0.75

Windowless detectors combining retarding potential analyzers and CBS type 14-stage linear focussed electron multipliers were designed and built for laboratory XUV studies. These detectors were designed to study photoemission generated by incident and transmitted photons. Included were single and remotely controlled eight cathode units. A substantial counting plateau and a single electron peak or knee was observed during operation of these devices. Thin aluminum film development demonstrated the difficulty in making thin films with similar photoelectric properties in both sides. The feasibility of using a thin aluminum film coated with a layer of low density KCl as a combination XUV filter and high electron multiplier stage was demonstrated. Rugged detectors using planar retarding potential analyzers and electron multipliers were designed to study the electron energy (50 eV) distribution within and above the earth's atmosphere. Author (TAB)

N66-34919# Electro-Metrics Corp., Amsterdam, N. Y.
ACCESSORY EQUIPMENT FOR RADIO FREQUENCY COMPATIBILITY MEASUREMENTS Final Report, 23 Jun. 1964–9 May 1966
Robert Schlieman Ft. Monmouth, N. J., Army Electron. Command Jun. 1966 14 p
(Contract DA-28-043-AMC-00218(E))
(ECOM-00218(F); AD-635101) CFSTI: HC $1.00/MF $0.50

This is the final report on a project resulting in a compatible group of r-f accessory equipment for r-f compatibility measurements. This equipment includes commercial attenuators, isolators, directional couplers, signal samplers, and a frequency measuring system (10 Hz to 40 GHz). It also includes a set of five notch filters (14 Hz to 1 GHz). A standard response indicator (for measuring (S+N)/N ratios), and a wide-range deviation monitor (which operates between 1 and 40 GHz). Author (TAB)

N66-34934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOUR PARAMETER PULSE HEIGHT ANALYZER
Ciro A. Cancro, Norman M. Garrahan, and R. G. Mc Gowen Jul. 1966 17 p refs
(NASA-TM-X-55553; X-711-66-327) CFSTI: HC $1.00/MF $0.50 CSCL 09F

The Mark 9 Wide Dynamic Range A to D Converter and Readout System (ADCR-9) is a modified Mark 8 system (see GSFC X-611-64-183). The modifications consist of addition of charge amplifiers at the inputs of existing channels A, B, and C and the addition of a fourth D channel. The output of the fourth channel detector is analyzed (whenever A and B channel outputs are coincident) to determine whether its total charge is less than level D1, between level D1 and

D2 or greater than level D2. The level of D is indicated by the digital outputs on tape track 8-initial and tape track 8-delayed. The indexing bits normally connected to tape track 8-initial and tape track 8-delayed in the ADCR Mark 6 system are disconnected from this track in the Mark 9 system. Author

N66-34936*# Parametrics, Inc., Waltham, Mass.
ULTRASONIC TEMPERATURE MEASURING DEVICE
Fourth Quarterly Progress Report
E. H. Carnevale, L. C. Lynnworth, and S. L. Klaidman Jul. 1966 12 p refs
(Contract NAS3-7981)
(NASA-CR-72037) CFSTI: HC $1.00/MF $0.50 CSCL 20M

Molybdenum and rhenium wires have been cycled and tested ultrasonically up to 4000°R. After annealing, the wires exhibited sound velocities which were in reasonable agreement with velocities calculated from independent elastic moduli data. Ultrasonic instrumentation for automatically measuring temperature has been constructed. Preliminary bench tests of the unit have been conducted using a two inch sensor at room and elevated temperatures. Author

N66-34939*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF RUBIDIUM VAPOR ON BAYARD-ALPERT IONIZATION GAGES AT PRESSURES LESS THAN 1×10^{-6} TORR
Robert L. Summers Washington, NASA, Sep. 1966 12 p refs
(NASA-TN-D-3574) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Measurements have been made on Bayard-Alpert ionization gauges, operated in rubidium vapor over the pressure range of 10^{-9} to 10^{-6} torr. The effects of rubidium vapor on ionization gauges were determined. Effects traceable to the condensable nature of rubidium vapor were noted. The ionization-gauge sensitivity to rubidium was determined to be 9.1 times the nitrogen sensitivity of the gauge, with a probable error of 14%. In addition, the variation of gauge sensitivity with grid voltage was determined for both cesium and rubidium. Author

N66-34948# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
A MULTIPLE DETECTOR SYSTEM ADAPTED FOR TOTAL ABSORPTION GAMMA RAY SPECTROMETRY
John C. Saccenti, Robert E. Brady, and John H. Mc Neilly Jun. 1966 24 p refs
(NDL-TM-30; AD-635169) CFSTI: HC $4.00/MF $0.50

A total absorption gamma-ray spectrometer system utilizing anticoincidence shielding is described. The multi-detector system consists of a 9.50-inch diameter, 10.0-inch high NaI(T1) crystal annulus which serves as the anticoincidence guard. A 3.31-inch-diameter cylindrical cavity extends completely through, and is symmetric with, the crystal axis. Two additional NaI(T1) crystals are positioned within the annulus cavity; one is removable for inserting samples. With the anticoincidence shielding, a factor of 6 reduction in the magnitude of the Compton portion of the cesium-137 spectrum can be achieved. For cobalt-60, the maximum reduction factor achievable is 25. For gamma energies less than 3 MeV, background is reduced by a factor of 3.3. Design flexibility permits coincidence, anticoincidence, and sumcoincidence operation. The system has effectively been used as an anticoincidence total absorption spectrometer, in coincidence for positron annihilation studies, and as an integral bias sum spectrometer. Author (TAB)

N66-34981# Army Foreign Science and Technology Center, Washington, D. C.
METHOD OF DESIGNING CURRENT PICKOFFS FOR GYRO POTENTIOMETERS
V. Yu. Shishmarev, L. I. Zakharova, and Z. F. Urazayev Jun. 1966 40 p Transl. into ENGLISH from Tekhnol. i Konstruirovaniye Giroproborov (USSR), no. 59, 1964
(FSTC-HT-23-113-66; TT-66-61578; AD-634796) CFSTI: HC $2.00/MF $0.50

A methodology is presented for the design of potentiometer pickoffs for gyro instruments to prevent loss of contact under vibrational loadings and to minimize contact and winding wear. Equations and graphical solutions are presented for cantilever brush supports using various materials. Author (TAB)

N66-35001# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
LECTURES ON ELECTRON MICROSCOPY. II: ALIGNMENT AND OPERATION OF THE ELECTRON MICROSCOPE FOR HIGH RESOLUTION
R. W. Horne (Agr. Res. Council, Cambridge, England) 24 Jun. 1965 29 p Lectures held 23-28 Jun. 1965
(ISS-65/24) CFSTI: HC $2.00/MF $0.50

The practical use and operation of the electron microscope is considered, with particular emphasis given to the alignment and the adjustment of the various lenses. Some of the problems of limitations in terms of resolution are discussed. Author

N66-35057# American Science and Engineering, Inc., Cambridge, Md.
AN ELECTROSTATIC ANALYZER TO MEASURE AURORAL ELECTRON ENERGY AND ANGULAR DISTRIBUTIONS
Final Report, 21 Jun.-20 Oct. 1965
William P. Reidy and E. R. Hegblom 28 Mar. 1966 66 p refs
(Contract AF 19(628)-5512)
(ASE-1211; AFCRL-66-275; AD-635162) CFSTI: HC $6.00/MF $0.75

An electrostatic analyzer designed to measure the energy spectrum and pitch angle distribution of electrons between 2 and 50 Kev in the upper atmosphere during an aurora is described. The details of the instrument's design, operation, and calibration are presented. The flights of two electrostatic analyzers on two Nike Iroquois rockets launched from Fairbanks, Alaska, in October 1965 are described; and a preliminary analysis of the data for one sweep over the energy range from 2 to 20 Kev is presented. TAB

N66-35114# California Univ., Berkeley. Electronics Research Lab.
FAR-INFRARED SPECTROMETER FOR MEASUREMENTS OF THE SYNCHROTRON RADIATION FROM A HOT ELECTRON PLASMA
S. Sesnic and A. J. Lichtenberg 29 Apr. 1966 97 p refs
(Contract AF 33(615)-1078; Grant NSF GP-2239; AF-AFOSR-138-64)
(ERL-65-28; AD-635226) CFSTI: HC $4.00/MF $0.75

A far-infrared spectrometer is constructed to measure the synchrotron radiation from a hot-electron plasma in the wavelength range between 0.1 and 4 mm. The echelette grating theory is reviewed, and the relevant formulae are derived. Utilizing the corrected Rowland's formula for the intensity distribution in various orders, the intensity distribution in the first and second order is calculated. Methods of filtering

unwanted frequencies are described. A rather novel method, incorporating phase-space concepts, is used to design the spectrometer. Measurements of spectrometer transmission losses are presented, including losses of individual elements such as light pipes, right-angle bends, and quartz windows. Experimental determination of the filtering characteristics of echelette grating filters, NaCl transmission filters, and wire mesh reflection and transmission filters are given and their effectiveness compared. Theory and experiment are compared for the grating filters. The spectrometer is used to check the linearity of an InSb photodetector over approximately a two-decade power range. Author (TAB)

N66-35157# Washington Univ., St. Louis, Mo. Dept. of Physics.

DEVICES FOR DETECTING AND TRACING THE PATHS OF IONIZING PARTICLES

Arthur L. Hughes 31 Jul. 1966 9 p ref
(Grant DA-ARO(D)-31-124-G427)
(AROD-3816-2; AD-635209) CFSTI: HC $3.00/MF $0.50

The performance of spark chambers traversed by heavily ionizing alpha particles from polonium-210 was studied. Bright sparks along the alpha particle tracks were readily obtained up to about 60 degrees with the normal to the electrodes. The densely packed ion-pairs favor the overlapping of the electron avalanches, thereby making it possible for the spark to follow the particle up to wide angles. Experiments were made showing that the addition of 0.1 percent or less of SF_6 very greatly reduced the lifetime of the free electrons initiating the electron avalanches. Author (TAB)

N66-35166*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.

A HIGH VACUUM CHAMBER WITH A DYNAMIC SEAL FOR VARYING ION ATTITUDE AND VELOCITY RELATIVE TO THE ENTRANCE OF A MASS SPECTROMETER Final Report, Part I

13 Jul. 1966 58 p refs
(Grant NsG-260)
(NASA-CR-77447) CFSTI: HC $3.00/MF $0.75 CSCL 14B

A high vacuum rotary chamber with a dynamic seal was designed, constructed, and tested with a radio frequency mass spectrometer with varying ion attitude (entrance angle) and entrance velocity relative to the spectrometer axis. Specifications for the construction and operation of the chamber are outlined. Configurations of various seals that were considered for the design, and of the rotary chamber itself are presented. The chamber performed reliably in an operating pressure range of 10^{-8} torr with negligible pressure rise and ion beam perturbation during rotation. The seals were secure enough to allow a minimum pressure of 3×10^{-8} torr to be attained overnight. During daily use for over one year it was not necessary to disassemble the chamber for maintenance purposes, and the properties of the system (such as pressure, torque, etc.) did not deteriorate noticeably during the period of use. The results of the test indicate that large dynamic vacuum seals can be used successfully. L.S.

N66-35180*# Yale Univ., New Haven, Conn.

DESIGN OF TANDEMLY OPERATED FAST SCAN HIGH RESOLUTION MASS SPECTROMETER-GAS CHROMATOGRAPHY Progress Report, Jan. 1–Jun. 30, 1966

[1966] 15 p
(Grant NsG-192)
(NASA-CR-77463) CFSTI: HC $1.00/MF $0.50 CSCL 20F

The principle of operation, and design of a tandemly operated fast electrical scan high resolution mass spectrometer that can rapidly monitor gas chromatographic effluents containing one microgram or less, are discussed. The instrument can record in real time or on FM magnetic tape, spectra extending over a decade in mass with a resolving power in the order of 1 in 10,000 or more at scan speeds of about 5 to 10 secs. The system is devised so that the data procured is readily amenable to computer techniques. The instrument can be applied to structural problems and can be used in a spaceborne instrument. The column can accept a wide range of sample sizes without serious overloading. In addition, sample splitting may be avoided or if necessary, small sample split ratios (1 to 4–8) can be used. The carrier gas flow rates are low and the concentration of solutes in the gas phase are high, providing ideal conditions for the use of enrichment devices for interfacing of the spectrometer and the chromatographic column. L.S.

N66-35235*# General Dynamics/Convair, San Diego, Calif.

BIDIRECTIONAL SPECTROREFLECTOMETER MANUAL

Apr. 1966 39 p
(Contract NAS8-20512)
(NASA-CR-77172; PIN-65-464; GD/C-DBE-66-007) CFSTI: HC $2.00/MF $0.50 CSCL 20F

A manual is presented for the spectroreflectometer which irradiates an opaque or translucent sample with monochromatic light and permits measurement and recording of collimated light reflected at various angles. Details are given on the instrument and components, and on instructions for unpacking, assembly, and alignment and operation procedures. N.E.N.

N66-35262# Purdue Research Foundation, Lafayette, Ind.

THE CALIBRATION OF THE PURDUE BROAD-RANGE MAGNETIC SPECTROGRAPH AND THE INCIDENT-BEAM-ENERGY ANALYZING MAGNET

E. Bleuler, D. J. Tendam, J. W. Hemsky, and C. L. Wiley Apr. 1966 98 p refs
(Contract AT(11-1)-1420)
(COO-1420-123) CFSTI: HC $3.00/MF $0.75

The Purdue broad-range, magnetic spectrograph is a modified version of the high-resolution particle spectrographs designed and built at M.I.T. and at the University of Notre Dame. For magnetic-field strengths below 9.5 Kgauss, alpha particles from ^{210}Po were used to perform the energy calibration of the spectrograph focal surface. The validity of the resulting low-field energy-calibration equation for the spectrograph was investigated at higher magnetic-field strengths; and, within the limitations imposed by the fixed energy of the deuteron beam from the Purdue cyclotron, the low-field energy-calibration equation appears to be accurate to within 0.1% for magnetic-field strengths below 13.75 Kgauss. The average (energy) resolving power of the spectrograph focal surface is $1.2 \cdot 10^3$ for a 1° half-angle of acceptance and is $0.87 \cdot 10^3$ for a 3° half-angle of acceptance. The solid angle of the spectrograph in a 1/2-inch by 5/8-inch entrance mask and 0.410-inch exit mask configuration varies smoothly from 0.43 m sr at s=0 cm to 0.30 m sr at s=75 cm. By using the spectrograph low-field energy calibration as a standard, an energy-calibration equation for the incident-beam-energy analyzing magnet was obtained; the accuracy of the analyzing-magnet energy-calibration equation is 0.1%. Author (NSA)

N66-35283# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Reaktorexperimente.

ABSOLUTE MEASUREMENT OF THE DECAY RATE OF A RADIOACTIVE EMITTER WITH COMPLEX DECAY SCHEME USING A 4π β-γ COINCIDENT INSTALLATION. THE ABSOLUTE MEASUREMENT OF ^{60}Co AND ^{58}Co [ABSOLUTMESSUNG DER ZERFALLSRATE EINES RADIOAKTIVEN STRAHLERS MIT KOMPLEXEM ZERFALLSSCHEMA MIT HILFE EINER 4π β-γ KOINZIDENZANLAGE. DIE ABSOLUTMESSUNG VON ^{60}Co AND ^{58}Co]

L. Dieck Jan. 1966 68 p refs In GERMAN
(JUL-355-RX)

A 4π β-γ coincidence installation was constructed. This installation contains, in addition to the 4π β methane flow through counter, two electronic γ channels stabilized against amplifier oscillations so that γ-γ coincidences and 3-fold coincidences between a β decay and 2γ decays can also be measured in addition to the β-γ coincidences. This measurement installation is the first 4π β-γ coincidence apparatus to contain a 4π β counter with a prerinsed chamber in order to prevent the introduction of air along with the preparation into the counting chamber. Circuits and measurement methods were worked out with which the apparatus can rapidly be adapted from the measurement of one radioisotope to the measurement of another. In the 4π β counter it is possible through separated cathode follower and a relayed circuit to determine separately the upper and lower β counter size. Therefore a new method is obtained for the determination of the correction for self coincidences. A correction method for the absolute measurement of ^{60}Co using the 4π β-γ coincidence installation was developed. In absolute measurements of ^{58}Co with a 4π β-γ coincidence apparatus a high counting yield for the secondary electrons in the 4π β counter is obtained because of the low contribution of the positrons to the total decay. The corrections for these secondary electrons and for the pseudo coincidences were very large. With a special measurement and correction method worked out for the absolute measurement of ^{58}Co, the corrections were determined so accurately that the resulting total correction factor could be determined to $\pm 1.5\%$. Author (NSA)

N66-35273# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

A GAMMA DOSE-RATE ALARM SYSTEM

J. E. Maddock May 1966 20 p ref
(AERE-M-1155) HMSO: 3s 6d

This memorandum describes the design and performance of an installed gamma dose-rate alarm system which provides warning indication at any single preselected dose-rate within the range of 10mr/h to 500r/h, at a low cost relative to other currently available equipment. The system, which can operate from either battery or a.c. mains supply, provides a visual indication showing whether the gamma dose-rate is below or above the pre-set warning level. Relay contacts are available for the operation of additional alarm-indicating devices. The equipment can function either as a single or multiple detector system. Author

N66-35278# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

A NUMERICAL STUDY OF THE MODE OF WORKING OF THE ULTRASONIC MICROMETER USED IN THICKNESS MEASUREMENTS OF STAINLESS STEEL TUBING

E. E. Aldridge Apr. 1966 34 p refs
(AERE-M-1742) CFSTI: HC $2.00/MF $0.50

A numerical study, made of a simple model of an isotropic elastic material, with properties similar to that of a metal, being isonified with a bounded beam, through a water column, showed that the sound energy reflected back to the transducer can have a pressure distribution such that the transducer receiving it, will exhibit a null output. The conditions to be met to produce this null are that there is a high characteristic acoustic impedance mismatch between the metal and the water and that the beam width and frequency are suitably chosen. Provided the beam width is relatively narrow, the null can be made to occur at a frequency sufficiently close to one of the half-wave dilatational resonances of the sheet, for it to be used as a means of measuring the thickness of the sheet. With these conditions further nulls are unlikely to occur, except at frequencies close to the higher harmonics of the half-wave dilatational resonances. Author

N66-35291# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Munich (West Germany). Institut fuer Physik der Atmosphaere.

METHODS FOR COMPLETE EVALUATION OF INFORMATION SUPPLIED BY A RADIATION FLUX RADIOPROBE [METHODEN ZUR VOLLSTAENDIGEN VERARBEITUNG DER VON EINER STRAHLUNGSSTROMRADIOSONDE GELIEFERTEN INFORMATIONEN]

Edgar Neuburger Jun. 1966 130 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-39; DVL-498) CFSTI: HC $4.00/MF $1.00

The subject of this report is a radiation flux meter which, for the first time, allows direct determination of vertical infrared radiation flux, counter-radiation, and emission without filters in such a manner that heat transfers to ambient air, which are difficult to determine, are explicitely considered by four simultaneously determined heat transfer coefficients each. The chief part of this radiation flux meter is a primary element consisting of three horizontal pairs of plates. The values of unknown quantities and their standard deviation mean errors were obtained by applying Fourier's heat conduction equations, extended by radiation and evaporation terms. The measured values are analysed by electronic data processing. A procedure is described in which, based on a representation of mathematical interrelations, formal rules result in a program which greatly excludes errors; it also permits to establish the relations between original representation and program representation. Seven ascents serve as examples for analysis. Author

N66-35299# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

AN ANTI-COINCIDENCE BETA SCINTILLATION COUNTER FOR LOW ACTIVITY SAMPLES

J. L. Waddingham and J. D. Rowe May 1966 23 p refs
(AERE-R-4248) HMSO: 3s

The source is placed in contact with a thin disc of plastic scintillator coupled to a 1 in. photomultiplier and the assembly is inserted inside a 2 in. well-type guard scintillator which has an associated 2 in. photomultiplier. The photomultipliers are connected in anti-coincidence. This counter has twice the efficiency for ^{90}Y, coupled with a lower background, than the MX 152 or GM4LB Geiger tubes employed in the normal anti-coincidence arrangement, and background reproducibility figures indicate a limit of detection (3σ) of 0.08 pCi for ^{90}Y in a forty-eight hour counting period. Author

N66-35302# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

COMPTON SCATTERING SPECTROMETER

C. G. Brown May 1966 26 p refs
(AERE-R-5073) HMSO: 4s

A Compton scattering spectrometer is described which uses a silicon solid state detector as the primary gamma ray scatterer, and an array of NaI-Tl scintillation counters to detect the scattered gamma rays. The resolution achieved is 8 keV (FWHM) with an efficiency of 2.3×10^{-9} from a small source. It has the advantage that a single peak only is obtained for each gamma ray energy. Examples are given of complex spectra from Ra^{227}, and a mixed fission product source. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-34126*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRUCTURAL ADHESIVE BONDING CONFERENCE
14 Mar. 1966 383 p refs Papers presented at conf. held at Huntsville, Ala., 15–16 Mar. 1966
(NASA-TM-X-57823) CFSTI: HC $7.00/MF $2.00 CSCL 13H

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2. DESIGN OF HEAVY-GAGE BONDED HONEYCOMB SANDWICH C. F. Herndon (Gen. Dyn.) 25 p (See N66-34128 20-32)
3. DESIGN OF THICK HONEYCOMB CORE STRUCTURES C. A. Haudenschild (Goodyear Aerospace Corp.) 20 p (See N66-34129 20-32)
4. MATERIALS FOR SPACE CABIN ENVIRONMENTS R. Holden (Grumman Aircraft Eng. Corp.) (See N66-34131 20-15)
5. CRYOGENIC ADHESIVE APPLICATION R. L. Long (Douglas Aircraft Co.) 102 p refs (See N66-34131 20-18)
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7. THE FUNCTION OF THE PLASTICS TECHNICAL EVALUATION CENTER (PLASTEC) H. E. Pebly, Jr. (Picatinny Arsenal) 18 p (See N66-34133 20-18)
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9. SECONDARY BONDING W. S. Stiles (N. Am. Aviation) 28 p (See N66-34135 20-15)
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12. INSPECTION OF HONEYCOMB STRUCTURES USING BI-REFRINGENT PLASTIC COATINGS H. M. Walker 30 p (See N66-34138 20-32)

N66-34130*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
SPACE CABIN MATERIALS
Robert Holden *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 14 p (See N66-34126 20-15) CFSTI: HC $2.00/MF $2.00

The outgassing characteristics of a number of non-metallics exposed to space craft cabin environment is reported. Included is a general description of analytical methods employed involving primarily gas chromatography and infrared spectroscopy. Behavior of materials in oxygen and vacuum is reflected in their percentage weight losses. Author

N66-34135*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
SECONDARY BONDING
William S. Stiles *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 28 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

Secondary bonding may be described as bonding operations which are done after the primary structure has been completed. It includes bonding general bracketry and miscellaneous hardware to any surface of the basic structure. Two types of bonding conditions are discussed: (1) in-station bonding where the assemblies are cured in conventional ovens and autoclaves and (2) out-of-station bonding which utilizes cold-bonding techniques and localized heating devices. This report highlights the secondary bonding procedures currently used on the Apollo capsule. The adhesive system, prefit and indexing of parts, surface preparation and adhesive lay-up bagging and curing, and general manufacturing tricks-of-the-trade are described in detail. Author

N66-34137*# Boeing Co., Renton, Wash. Commercial Airplane Div.
NONDESTRUCTIVE TESTING OF BONDING STRUCTURES WITH LIQUID CRYSTALS
La Marr Sabourin *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 12 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

A brief discussion is given of liquid crystal cholesterol esters, with emphasis on their optical characteristics as they respond to thermal environment changes that produce variations in color. The advantages of these materials as temperature indicators are speed of response, reversibility, and reproducibility. In order to visualize the colors associated with these materials it is necessary to paint liquid crystals over a dark background of the part to be tested. Approximately one gram of these mixtures will cover one square foot to a thickness of about ten microns. Applications include checking for bond defects, checking electronic circuits for hot spots, and rivet checks in structures where they have to be insulated from dissimilar metals. C.T.C.

N66-34178# Sensory Systems Lab., Tucson, Ariz.
STUDY AND DEVELOPMENT OF MUSCLE SUBSTITUTES Final Report
Howard A. Baldwin, Ernest L. Morrison, Jr., and Ronald L. Brown Wright-Patterson AFB, Ohio, AF Avionics Lab., May 1966 48 p refs
(Contract AF 33(615)-1232)
(AFAL-TR-66-139; AD-634187) CFSTI: HC $2.00/MF $0.50

The investigations in the current program concern the application of the low pressure contractive 'muscle-like' devices to electrical power generation, peristaltic pump action, and a single function electromyograph control system. Design studies indicate typical operational characteristics for the cited device applications. Predicted pump and generator power transfer efficiencies indicate no direct advantages when compared to current systems. Areas of utility for the contractive devices in limited control functions are indicated. Author (TAB)

N66-34244# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEFECTOSCOPY OF THIN-WALLED TUBES
V. V. Gorskiy, V. M. Zakharov, G. A. Nikitin, V. K. Popov, V. T. Pronyakin et al 16 Feb. 1966 35 p refs Transl. into ENGLISH of a Paper Presented at the Symp. on Nondestructive Testing in Nucl. Technol., Bucharest, 17–21 May 1965
(FTD-MT-65-562; TT-66-61411; AD-633697) CFSTI: HC $2.00/MF $0.50

Along with standard methods of checking and testing tubes, ultrasound and eddy currents are widely applied at present for detection of hidden defects (cracks, nonmetallic inclusions, stratifications, blisters) and deep notches and scratches on the internal surface of the tube, for the determination of dimension of grains, and for the measurement of wall thickness and corrosion of samples during autoclave tests. The conducted investigations and accumulated experience show that ultrasonic flaw detectors are more sensitive to small internal defects and notches of the surface to tubes than eddy current equipment. The latter basically is used for measuring the thickness of tube walls and samples during corrosion tests. In the report certain questions of the theory of ultrasonic defectoscopy of thin-walled tubes are considered and a description of defectoscopy equipment now applied is given. Author (TAB)

N66-34292# Bureau of Ships, Washington, D. C.
HYDRAULIC AUTOMATION SYSTEMS
M. D. Lemberg Jun. 1966 115 p refs Transl. into ENGLISH of the Book "Sistemy Gidroavtomatiki" Moscow, Energiya Publishing House, 1965
(BUSHIPS-TRANS-984; TT-66-61512; AD-634397) CFSTI: HC $4.00/MF $0.75

The book contains materials on the classification, principle of operation, and range of application of hydraulic automation systems. In the book, consideration is given to the principal layouts and equipment involved in the systems of automatic control and regulation, constructed on hydraulic automation elements. The book is intended for engineering-technical workers concerned with the problems of the automation of the production processes. Author

N66-34309*# Marquardt Corp., Van Nuys, Calif.
APOLLO SERVICE MODULE REACTION CONTROL SYSTEM ENGINE INJECTOR/CHAMBER SEAL STUDY Final Report, 12 Jul. 1965–12 May 1966
J. Puntar Jun. 1966 558 p refs
(Contract NAS9-4775)
(NASA-CR-65453; PR 3008-F) CFSTI: HC $6.07/MF $2.75 CSCL 11A

An injector head-to-combustion chamber seal for the radiation-cooled, Apollo Service Module Reaction Control System (S/M RCS) Engine was developed and evaluated. Numerous photographs, graphs, drawings, and charts illustrate analytical studies, and test evaluation of materials for full scale seals, which were subjected to structural and nonstructural bench tests in addition to thermal and firing tests in qualification-type Apollo S/M RCS engines. Three different seal design configurations, generically identified as: (1) composite, (2) straight thinwall, and (3) conical thinwall were developed. Each configuration was fabricated from two materials and/or material systems, and the thermal resistances of the six combinations are tabulated. The composite designs demonstrated resistances approximately six times greater than the current Apollo seals (thermal resistance of 5 Hr-°F/BTU). Two out of six various seal design–material combinations developed and evaluated exceeded the objective seal thermal resistance, consistent with meeting structural and leakage requirements. R.L.I.

N66-34367*# Southwest Research Inst., San Antonio, Tex.
NON-GLASSY INORGANIC FIBERS AND COMPOSITES
Cameron G. Harman Washington, NASA, Aug. 1966 44 p refs Sponsored by NASA
(NASA-SP-5055) GPO: HC $0.35; CFSTI: MF $0.50 CSCL 13H

General summaries of NASA-generated and related information dealing with fibers, filaments, and composites are presented in a review of *Non-glassy Inorganic Fibers and Composites*. Concept and theory of fiber-reinforced composites is discussed, as are whiskers, polycrystalline fibers, and metal wires. Attention is given to boron carbide whiskers, boron filaments, and refractory ceramic fibers. Among the metal-fiber-reinforced metallic composites considered are: (1) copper reinforced with tungsten fiber, (2) boron-aluminum composites, (3) boron-magnesium composites, and (4) composites with *in situ* fibering. Organic and glass fibers, as well as compositions with organic matrices are included. M.W.R.

N66-34443*# Clark (David) Co., Inc., Worcester, Mass.
DEVELOPMENT AND EVALUATION OF PRESSURE SEALING CLOSURE Six Monthly Progress Report
Oct. 1963 28 p
(Contract NAS9-1186)
(NASA-CR-65452) CFSTI: HC $2.00/MF $0.50 CSCL 13H (Declassified)

Details are reported on the redesign of a mechanically operated full pressure suit entrance closure for use in spacesuits. Fabrication and testing procedures are given for the crank-operated gear assembly, flexible cable (spring lock and seal), and cable storage case. A prototype torso area gas container was fabricated with a twelve-inch prototype sealing enclosure, and tabular data indicate the leak rate. R.L.I.

N66-34532*# Illinois Univ., Urbana. Coordinated Science Lab.
PUMPING SPEED OF GETTER-ION PUMPS AT LOW PRESSURES
Andras Dallos and Fortunat Steinrisser Jun. 1966 18 p refs (Grant NsG-376; DA-28-043-AMC-00073(E))
(NASA-CR-77470; R-302; AD-634594) CFSTI: HC $1.00/MF $0.50 CSCL 13K

Pumping speeds of commercial diode and triode type getter-ion pumps were measured for the gases H_2, He, and N_2 over the pressure range from about 10^{-11} Torr to 10^{-6} Torr. At 10^{-10} Torr, the pumping speed was 15–25% of the speed at 10^{-6} Torr where the pumps attained the rated speed. Pumping speed measurements as a function of time showed that the pumping speed decreased generally only slightly over a period of one day. Strong saturation was found only for He at pressures above 10^{-7} Torr. No significant difference between diode and triode in the pumping speed vs. time or vs. pressure curves was observed. In the diode, pump currents were measured. The quantity P.S/I (P=pressure, S=pumping speed, and I=current) was found to be pressure independent for short pumping times. The numbers (in molecules or atoms pumped per charge) are: 0.5 (H_2), 0.6 (He), and 0.2 (N_2). Author (TAB)

N66-34557# Thermal Dynamics Corp., Lebanon, N. H.
PLASMA ARC MACHINING Final Report, Aug. 1965–Feb. 1966
James F. Ordway, George A. Colligan, and James A. Browning May 1966 86 p refs
(Contract DA-19-066-AMC-275(W))
(AMRA-CR-66-03/F; AD-635043) CFSTI: HC $3.00/MF $0.75

The concept of metal removal by plasma-arc machining utilizing dc transferred and non-transferred arc techniques was explored. Tests on various metal alloys at a power level of 50kW show that optimum torch-to-work geometry, feed and surface speed provide high removal rates, surface finishes of 30 microinch (RMS) were obtained and metallurgical changes were generally of a surface nature. A variety of workpieces including low and medium carbon, low alloy and high nickel steels, and titanium were used in the tests.
Author (TAB)

N66-34606*# Michigan Univ., Ann Arbor.
USING RADIOKRYPTON FOR DETECTION OF LEAKS IN SPACE VEHICLES Final Report
15 Jun. 1966 34 p
(Contract NAS8-2579)
(NASA-CR-77304; IN-R-QUAL-66-6) CFSTI: HC $2.00/MF $0.50 CSCL 14D

This document is a guide for acquiring and using radiokrypton as a leak detection medium for testing space vehicle systems and related components. Included are a procedure for the dilution of radiokrypton to a usable concentration, charts and graphs indicating leak rate measurements which were made with the various types of commerical equipment available, and a sample test procedure using radioactive test gas.
Author

N66-34612# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
STATIC OUTDOOR EXPOSURE TESTS ON SOLID FILM LUBRICANT COATINGS Interim Report
George P. Murphy and Francis S. Meade May 1966 24 p refs
(RIA-66-1546; AD-635465) CFSTI: HC $1.00/MF $0.50

An investigation was made to: (1) determine the affect of several Rock Island Arsenal solid film lubricant formulations on the corrosion protection provided by several metal substrates and (2) determine the optimum solid film lubricant–substrate combination providing greatest corrosion protection. Conclusions obtained from the first series of tests are: (1) The solid film lubricant coating containing graphite decreased the corrosion protection provided by all the substrates and (2) The other solid film lubricant coating increased the corrosion protection provided by the zinc phosphatized substrate but did not substantially improve the corrosion protection provided by the other substrates. The limited exposure period to date of the second series of tests produced the following conclusions: (1) One solid film lubricant formulation greatly increased the corrosion protection provided by zinc phosphatized steel. (2) No corrosion has occurred on the remaining substrates coated with this formulation and (3) Increasing the lubricant film thickness greatly increases the corrosion protection provided by the lubricant. Author (TAB)

N66-34643*# National Aeronautics and Space Administration, Washington, D. C.
EVALUATION OF CONTRACTOR QUALITY PROGRAM PLAN
Jul. 1966 43 p
(NASA-TM-X-57841; RA-001-009-1A) CFSTI: HC $2.00/MF $0.50 CSCL 14D

A guideline is presented to insure that all required quality program provision for the Apollo Program are considered in evaluation of a contractor's program plan. Checklists are included for rating such factors as packaging, handling, and inspection.
S.P.

N66-34644*# National Aeronautics and Space Administration, Washington, D. C.
EVALUATION OF SUPPLIER INSPECTION PLAN
Jul. 1966 24 p
(NASA-TM-X-57842; RA-001-010-1A) CFSTI: HC $1.00/MF $0.50 CSCL 14D

These guidelines are presented as an aid to Apollo Program personnel in evaluating a suppliers inspection system. To make the evaluation a measurable quantity, a numerical rating system is included in the procedure. A detailed sample of the inspection plan evaluation report is included.
H.S.W.

N66-34645*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
FAILURE INFORMATION NOTEBOOK
1 Mar. 1966 853 p refs
(NASA-TM-X-57844; SR-QUAL-66-4) CFSTI: HC $11.52/MF $4.00 CSCL 14D

The Failure Information Notebook (FIN) catalogs recorded operational data in the running time system for major components of the electronic, electromechanical, and mechanical systems of the Saturn I launch vehicle and associated ground support equipment. The total operating time or cycles, qualification tests, failure categories and frequencies, failure rates, and observed Mean Time Before Failure (MTBF) are given in this composite reference source. All components are indexed to permit a rapid comparison of data from past performance; this information could also be used in predicting future performance.
Author

N66-34682*# Franklin Inst., Philadelphia, Pa. Research Labs.
DETERMINATION OF GAS BEARING STABILITY BY RESPONSE TO A STEP-JUMP Interim Report
H. G. Elrod, Jr., J. T. Mc Cabe, and T. Y. Chu Jul. 1966 53 p refs Sponsored in part by NASA
(Contract Nonr-2342(00))
(NASA-CR-77221; A2049-27) CFSTI: HC $3.00/MF $0.50 CSCL 13I

The stability of a gas bearing is treated by a procedure in which the bearing film is characterized by its responses to step–jump displacements. Duhamel's theorem is invoked to generalize these step responses in a system of dynamical equations. Stability is determined by calculation of a growth factor for each degree of freedom.
Author

N66-34689# Royal Aircraft Establishment, Farnborough (England).
FORCES AND DISPLACEMENTS IN THE CONTACT SURFACE PLANES OF ROTATING TYRES OF LORRIES [KRAEFTE UND BEWEGUNGEN IN DER BODENBERUEHRUNGSFLAECHE ROLLENDER REIFEN VON LASTKRAFTWAGEN]
Gerhard Bode Feb. 1966 94 p refs Transl. into ENGLISH from Deut. Kraftfahrtforsch. Strassenverkehrstech. (Duesseldorf), no. 148, 1961 p 1–38
(RAE-LIB-TRANS-1149) CFSTI: HC $3.00/MF $0.75

The tests described seek to clarify the forces acting in the footprint of medium-heavy lorry tires on a road surface, using electronic measuring apparatus. With this apparatus, the momentary values of the forces in the tire/road contact plane are measured and recorded. By changing the test conditions step by step, particularly those relating to tire construction and tread, the effects of the individual factors are assessed. The effects of various operating conditions, loadings, tire pressures and depths of tread are examined and the sources of the shearing forces investigated.
Author

N66-34880# Royal Aircraft Establishment, Farnborough (England).

INVOLUTE TEETH FOR PARALLEL AXES WITH PINION TOOTH NUMBERS FROM 1–7 [EVOLVENTENVERZAHNUNGEN FUER PARALLELE ACHSEN MIT RITZELZAEHNEZAHLEN VON 1 BIS 7]

Karlheinz Roth May 1966 39 p refs Transl. into ENGLISH from VDI (Ver. Duet. Ingr.) Z. (Dusseldorf), v. 107, no. 6, 1965 p 275–284

(RAE-LIB-TRANS-1167) CFSTI: HC $2.00/MF $0.50

The size of a transmission may be reduced by the use of small gear teeth and the choice of small tooth numbers which results in larger module values and therefore gears with a greater load capacity and a reduction in noise. A 20° involute gear system with parallel axis is described, with straight-toothed and helical-toothed pinions having one to five teeth. Author

N66-34764# Southwest Research Inst., San Antonio, Tex. Dept. of Aerospace Propulsion Research.

FUNDAMENTAL INVESTIGATION OF LIQUID-METAL LUBRICATED JOURNAL BEARINGS Quarterly Technical Report No. 6

R. A. Burton and Y. C. Hsu 1 Mar. 1966 47 p refs

(Contract AT(11-1)-1228)

(SWRI-1228-8-20; RS-482) CFSTI: HC $2.00/MF $0.50

The calculated performance of finite tilting pad bearings is reported in terms of mean pressure and center-of-pressure location, as functions of length/width ratio, and tilt angle. The performance of a stepped pad is calculated by an iterative numerical program, and the pressure distribution is shown to resemble closely that measured experimentally. Interactions between a shear flow and pressure flows of different directions and magnitudes are investigated by application of the mixing length approach. Author (NSA)

N66-34790*# Titeflex, Springfield, Mass.

DESIGN, DEVELOPMENT, MANUFACTURE AND PREFLIGHT CERTIFICATION TEST OF FLEXIBLE HOSE ASSEMBLIES Final Report, Jun. 29, 1965–Feb. 24, 1966

J. Hengartner [1965] 9 p *Its* Rept.-66-TTR-027

(Contract NAS8-11791)

(NASA-CR-77408) CFSTI: HC $1.00/MF $0.50 CSCL 13K

Development of three flexible hoses and fittings is reported, and performance is summarized for the assemblies which are made of convoluted teflon-innercore reinforced with wire braid. The items developed are: (1) 500 ft of −8 size with 800 fittings, 25 ft of −12 size hose with 50 fittings, and 60 ft of −16 size hose with 100 fittings. The use of aluminum wire braid yields a hose construction with unique, weight, performance, and bend characteristics. The crimped assemblies provided a good workable fitting attachment which functioned normally without cracking, leakage, or blow-off; and results are present for burst characteristics, weight and flexure, and leakage tests. It is noted that the contract was cancelled before production hardware was furnished. M.W.R.

N66-34807# Shell Oil Co., Wood River, Ill. Research Lab.

STUDY OF HELICOPTER GEAR LUBRICATION Quarterly Progress Report, Dec. 1965–Feb. 1966

D. R. Bailey and S. J. Beaubien 17 Jun. 1966 21 p refs

(Contract NOw-65-0323-c)

(QPR-4; AD-634033) CFSTI: HC $1.00/MF $0.50

Studies to determine the effect of hardness on the fatigue life of gears were continued. In constant load tests preceded by break-in, using MAAG B gears and with two synthetic tetraester-base lubricants it was found that an increase in hardness of about five Rockwell C (RC) units resulted in a doubling of gear life. At the same constant transmitted load of 496 lb, the MIL-L-23699 (A) lubricant was superior in regard to fatigue life, giving about 3-1/2 times the life of MIL-L-23699 (B) over a hardness range of 40 to 63 Rc. The magnitude of transmitted load was found to have a considerable effect on fatigue life over a range of hardness. In tests with MIL-L-23699 (A) oil, reducing the load from 637 to 496 lb resulted in a nine-fold increase in life. Based on a straight-line relationship between load and log life, this amounts to doubling the gear life for each decrease in transmitted load of 45 lb. Tests run on gear systems of different chemical composition showed a considerable variation in score load and fatigue life. There is apparently no simple relationship between chemical composition, surface finish, or hardness, and the performance of these gears. Author (TAB)

N66-34828*# National Aeronautics and Space Administration, Washington, D. C.

DYNAMIC ACCURACY OF MACHINE TOOLS WITH PROGRAMED CONTROL

B. I. Andreychikov *In its* Autom. Regulation and Control Jul. 1966 p 16–31 refs (See N66-34826 20-10) CFSTI: HC $7.00/MF $2.50

The dynamic reproduction accuracy of metal-cutting, program controlled machine tools is discussed. For purposes of standardization of dynamic accuracy, and comparisons of different machine tools, the characteristic portions of a typical part profile are presented, as are the corresponding typical input functions of individual servomechanisms. A nomogram for calculating the steady-state error with machining of a circular arc in rectangular coordinates is given. Methods are reported for calculating errors with sharp breaks of the profile (rectangular coordinates), and errors with complex input functions (polar coordinates). Mathematical expressions relating the error on the contour (i.e., in the distance from the contour obtained during reproduction of the program to the given contour) with the error in the translational movement of the cutter are included. R.Li.

N66-34840# Martin Co., Denver, Colo.

CENTER FOR HIGH ENERGY FORMING Fourth Quarterly Technical Progress Report, Apr. 1–Jul. 1, 1966

Arthur A. Ezra 1 Jul. 1966 26 p refs Prepared jointly with Denver Univ.

(Contract DA-19-066-AMC-266(X))

(AMRA-CR-66-0514; CR-65-77; AD-635486) CFSTI: HC $1.00/MF $0.50

A key word end identifier list has been prepared to facilitate the retrieval of documents relevant to high energy forming, which are being incorporated into a computer retrieval program. The development of instrumentation has continued for two classes of experiments; one is the plane wave loading of flat specimens using mousetrap techniques for shock hardening studies. The other is the expanding ring technique for determining dynamic stress–strain relations. Solutions have been obtained for a set of simplified differential equations of motion of the large dynamic plastic deformation of circular blanks. Experimental checks have shown fair agreement. The largest source of error is in the estimate of energy delivered to the blank from the explosive. Firsthand coupling experience was obtained with an Air Force program for explosively forming 10-ft-diam domes for the Titan. Technical difficulties arose that were solved by personnel of the center. Problems identified will be reflected in the future research programs of the center. The first 10-ft production dome was successfully formed on June 24, 1966. Author (TAB)

N66-34941# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATION OF THERMAL CONDITIONS OF ROLLER BEARINGS OF GAS-TURBINE ENGINES

V. M. Demidovich 17 Jan. 1966 18 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), no. 66, 1961 p 49–62

(FTD-MT-65-32; TT-66-61690; AD-635280) CFSTI: HC $4.00/MF $0.50

The method of thermal calculation of GTE roller bearings permits solving of the problem, important for practice, of calculating the necessary magnitude of circulation of oil through housings of bearings, which ensures operation of the latter at assigned operating temperature, which increases reliability and long service life of their operation. Author (TAB)

N66-35011# North American Aviation, Inc., Los Angeles, Calif.

DEVELOPMENT AND EVALUATION OF DIFFUSION BONDED LAMINATED SECTIONS Interim Engineering Progress Report No. 1, 15 Mar.–30 Jun. 1966

Paul Miskulin, Harold J. Greenspan, and Ronald D. Brunken Wright-Patterson AFB, Ohio. AF Mater. Lab., Jun. 1966 52 p ref

(Contract AF 33(615)-3515)

(AFML-IR-9122-I; AD-635027) CFSTI: HC $3.00/MF $0.50

Efforts in the development of press bonding of Ti-6Al-6V-2Sn during this period consisted of constructing an 8 by 8-in. platen press and testing the functioning of the equipment. Minor adjustments in pressure control were required to achieve precise bonding pressures. Evaluation of bonding parameters consisted of producing 12 3 by 3 by 3-in. billets. Bonding temperatures varied, in addition to percent billet deformation and hold time at bonding temperatures. Several tooling concepts were tested to examine the need for internal and external tooling in making laminate sections. These studies revealed the need for internal tooling support. Metallographic examination of bonded laminates showed that well-bonded joints could be obtained, but billet deformations in excess of 20 percent were required to achieve uniformly high ductility throughout the billet. Appropriate bonding temperatures are between 1600° and 1650°F. Studies of sheet finish were conducted. A 2D finish was required to produce soundly bonded laminates. Grit blasted finishes produced bonded interfaces with pronounced voids. Experiments were conducted on reducing the amount of edge bulging. Boron nitride was found to be promising material to reduce friction between the retort and billet. Author (TAB)

N66-35016*# Marlin-Rockwell Corp., Jamestown, N. Y. MRC Research.

SPIN AXIS BEARINGS Summary Report

Daniel J. Howles and Harold E. Munson 27 Jun. 1966 77 p

(Contract NAS8-5441)

(NASA-CR-77365) CFSTI: HC $3.00/MF $0.75 CSCL 13I

Twelve experimental lots of spin axis bearings, involving nine different raceway finishes, were manufactured. After dynamic testing of the bearings in gyro assemblies, bearing failures were analyzed. From the combination of knowledge of manufacturing techniques, documentation of prerun and postrun bearing measurements, life test data, and failed bearing analyses, several conclusions were reached: (1) three methods of finishing spin axis bearing raceways produce superior performance and life under marginal lubrication conditions, (2) bearing life cannot be correlated with high luster under magnified visual observation nor with geometry of the race in the low microinch range, (3) measurement data from instruments were most useful for process and contamination control and historical records, rather than as the final criteria for predicting bearing life, and (4) bearings with unidirectional, circumferential surface finish lay performed better than those with irregular or cross-the-race lay. Additional work was done on controlling the oil bleed rate from the impregnated retainers. The results demonstrated the promise of this approach toward improving bearing life, but further development is necessary before it can be incorporated into operational gyros. Author

N66-35025# Brush Beryllium Co., Cleveland, Ohio. Product Engineering and Development Dept.

A STATISTICAL ANALYSIS OF BERYLLIUM CROSS-ROLLED SHEET, HOT PRESSED BLOCK AND RING ROLLED FORGINGS

Bryce King and Harold Wyatt Mar. 1965 13 p refs

Three methods of producing beryllium (i.e., cross rolled sheet, roll ring forgings, and hot pressed block) were tested and compared in relation to the spacer that joins the guidance and control compartment of the Minuteman missile with its reentry vehicle. The spacer was chosen because it requires large quantities of sheet, block, and forgings; it was the first production beryllium structure with primary load carrying capacity; and the beryllium supplied was used in fabricating intricate structure involving such design and fabrication techniques as forging, hot forming, chem milling, and hole drilling. The statistical procedure used is discussed, and the results of analyzing beryllium property data from 190 roll ring forgings, 53 hot pressed blocks for roll ring forgings, and 51 sheets are presented in tabular form. Details on the percentage variation of aluminum and titanium alloys to the three types of beryllium are also tabulated. Results indicated that beryllium can be successfully manufactured in production to meet specification and design requirements and the three types of beryllium showed production variables comparable to those of accepted materials such as aluminum and titanium. L.E.W.

N66-35035# Royal Aircraft Establishment, Farnborough (England).

THE USE OF PINS WITH FLATS TO INCREASE THE FATIGUE LIFE OF ALUMINUM ALLOY LOGS

B. C. Clarke Jan. 1966 16 p ref

(RAE-TR-66015) CFSTI: HC $1.00/MF $0.50

Pins with machined flats were used to improve the fatigue life of aluminum alloy lugs. A worthwhile increase in life was obtained, the magnitude of which depended on the depth of flat. The choice of optimum pin geometry is discussed. Author

N66-35060*# Electro-Optical Systems, Inc., Pasadena, Calif.

DEVELOPMENT AND TESTING OF POROUS IONIZER MATERIALS, PART I Summary Report, Feb. 1966–May 1966

M. Le Chance, H. Todd, K. Butler, B. Thompson, and B. Kuskevics 1 Sep. 1966 224 p refs

(Contract NAS3-7103)

(NASA-CR-54707; EOS-6650) CFSTI: HC $3.75/MF $1.25 CSCL 13H

Porous tungsten ionizers were prepared from: (1) fine W microspheres, with additions of fine angular Ta or Ta+Re particles, and (2) fine angular W, with additions of Cu flake and BN particles. Ta and BN were added to minimize structural changes in service and to increase useful ionizer life; nonreactive Cu flake was added to increase pore-to-solid ratio and provide desirable pore parameters, with subsequent Cu elimination. Ionizers of type (1) were characterized by relative densities >70%, pore densities up to 1.4×10^9, and greatly extended service lifetimes; type (2) by relative densities <70%, coarser

pore structures, excellent thermal stability at 1600° to 1800°C, and economy of fabrication. Evaluation of type (1) ionizers containing iridium was limited to preliminary tests, in which Ir was demonstrated to promote grain growth and pore coarsening. Two W-5Ta-10Re ionizers had neutral fractions ~7 and 4X lower than pure spherical-base tungsten; an ionizer from the W-8Cu-2BN mixture exhibited neutral fractions ~13 and 5X lower than the pure-tungsten comparison material. These major reductions in neutral efflux are attributed to the beneficial effects of the additive elements on pore parameters. Author

N66-35151# Springfield Armory, Mass.
HIGH-ENERGY RATE-FORMING
Earl H. Abbe and John F. Panda 27 May 1966 37 p refs
(SA-TR18-1101; AD-634916) CFSTI: HC $1.50/MF $0.50

Thin wall 1015 and 4130 tubular steel specimens were bulged to a simple shape using explosive, electrohydraulic and cartridge-hydraulic techniques to determine the effects of structure and energy media upon the formability of the two materials. Maximum expansion (40%) without splitting was obtained with the cartridge-hydraulic system on the spheroidized 4130 steel tube specimens. pressures, rise times, strain rates, and metal-deformation velocities were determined for the specimens bulged with the cartridge-hydraulic system. Reduction of wall thickness and increases in hardness of the two materials in the bulged area were comparable for all three forming techniques in both the spheroidized and annealed conditions. Author (TAB)

N66-35217*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
BORE SEAL TECHNOLOGY TOPICAL REPORT
P. E. Kueser, J. W. Toth, and R. C. Mc Rae Dec. 1964 304 p refs
(Contract NAS3-4162)
(NASA-CR-54093; WAED-64.54E) CFSTI: HC $4.25/MF $1.75 CSCL 13H

This report contains thermophysical, compatibility, and mechanical property data on ceramic-to-metal seal technology for the design of advanced space electric power systems. The application of ceramic-to-metal bore seals to actual designs is described and discussed. The thermophysical and mechanical properties at high temperatures of high purity alumina, high purity beryllia, Nb-1Zr, tantalum T-111, and niobium D-43 are reported. The metalizing braze method and the direct bonding active metal braze process of joining ceramic to metals were investigated. The metalizing method produced joints that were too brittle to insure an adequate seal. The active metal braze was used on the representative bore seals. Of the active metals systems studied for the ceramic-to-metal seal, the 56% Zr, 28% V, 16% Ti system was the best. Alkali-metal exposure tests showed that the silica content of the ceramic must be below 50 parts/million. Static capsule tests were used for the quantitative evaluation at 1000° and 1600°F for compatibility of the bore seal materials and brazed assemblies with high purity potassium, lithium, and sodium-potassium eutectic alloy. A ceramic body of Thermalox 998 beryllia, a Zr-V-Ti brazing alloy, and a metal member of Nb-1%Zr appears promising for lithium and potassium high temperature exposure. R.N.A.

N66-35224*# North American Aviation, Inc., Los Angeles, Calif.
TITANIUM S-IC SKIN SECTION Phase I Report, 29 Jun.-10 Dec. 1965
A. G. Jones 10 Dec. 1965 50 p ref
(Contract NAS8-20530)
(NASA-CR-77532; NA-65-1043) CFSTI: HC $2.00/MF $0.50 CSCL 13H

This report describes the engineering studies and design effort, the fabrication of roll diffusion bonded test packs, and the laboratory testing and analysis of the titanium panels produced in the test packs. Design drawings, fabrication and test data, and photographs are included. Author

N66-35230*# North American Aviation, Inc., Los Angeles, Calif.
TITANIUM S-IC SKIN SECTION Phase I Supplement Report, 8 Nov. 1965-11 Mar. 1966
A. G. Jones 24 Mar. 1966 58 p
(Contract NAS8-20530)
(NASA-CR-77533; NA-66-57) CFSTI: HC $3.00/MF $0.75 CSCL 13H

This report describes the design and fabrication of two roll diffusion bonding test packs and the laboratory evaluation of the titanium panels produced from those packs. The report also describes the rolling of a steel plate, representing a full-scale pack, to establish feasibility guide lines for production. Pertinent design drawings, charts, photographs, and other illustrative material are included. Author

N66-35231*# North American Aviation, Inc., Los Angeles, Calif.
TITANIUM S-IC SKIN SECTION Phase II Report, 29 Nov.-24 Dec. 1965
A. G. Jones 28 Dec. 1965 39 p
(Contract NAS8-20530)
(NASA-CR-77531; NA-65-1103) CFSTI: HC $2.00/MF $0.50 CSCL 13H

The manufacturing plan for the fabrication of the full-scale integrally stiffened titanium skin section is described. Also included are descriptions of the quality assurance (inspection) plans and the test evaluation program. Design drawings and photographs pertinent to the plans for the full-scale skin section also are presented in this report. Author

N66-35239*# Illinois Univ., Urbana. Coordinated Science Lab.
PUMPING SPEED OF GETTER-ION PUMPS AT LOW PRESSURES
Andras Dallos and Fortunat Steinrisser Jun. 1966 20 p refs
(Grant NsG-376; Contract DA-28-043-AMC-00073(E))
(NASA-CR-77480) CFSTI: HC $1.00/MF $0.50 CSCL 13K

Pumping speeds of commerical diode and triode type getter-ion pumps were measured for the gases H_2, He, and N_2 over the pressure range from about 10^{-11} Torr to 10^{-6} Torr. At 10^{-10} Torr, the pumping speed was 15–25% of the speed at 10^{-6} Torr where the pumps attained the rated speed. Pumping speed measurements as a function of time showed that the pumping speed decreased generally only slightly over a period of one day. Strong saturation was found only for He at pressures above 10^{-7} Torr. No significant difference between diode and triode in the pumping speed vs. time or vs. pressure curves was observed. In the diode, pump currents were measured. The quantity P·S/I (P=pressure, S=pumping speed, and I=current) was found to be pressure independent for short pumping times. The numbers (in molecules or atoms pumped per charge) are: 0.5(H_2), 0.8(He), and 0.2(N_2). Author

N66-36244*# Pyrogenics, Inc., Woodside, N. Y.
STUDY OF THE USE OF VAPOR AND VACUUM TECHNIQUES FOR THE DEVELOPMENT OF HIGH STRENGTH FILAMENTARY MATERIALS Summary Technical Report, 22 May 1965–21 May 1966
William A. Robba [1966] 46 p refs
(Contract NASw-1201)
(NASA-CR-77510) CFSTI: HC $2.00/MF $0.50 CSCL 13H

The process involves the deposition of pyrolytic graphite thin films on liquid metal substrates as a means of producing continuous high strength filaments. No evidence of reacing continuous high strength filaments. No evidence of reaction of the liquid metal with the graphite was found at temperatures as high as 2160°C. Experimental vapor deposition apparatus was designed to produce films under controlled conditions and in sufficient quantities for evaluation. Parameters varied included time, temperature, pressure and flow. Filaments were screened by testing tensile strength in a simple test rig. Specimens were then examined metallographically. The target objective of 100,000 psi tensile strength was reached when an as-deposited filament 2.0$_\mu$ thick reached 120,000 psi tensile strength. Author

N66-36271# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
STUDY OF THE MACHINING OF URANIUM CARBIDE RODS OBTAINED BY CONTINUOUS CASTING UNDER ELECTRON BOMBARDMENT
P. Rousset and A. Accary Oct. 1965 43 p refs Transl. into ENGLISH from French report CEA-R-2733, Jul. 1965
(AERE-TRANS-1052) HMSO: 7s

Consideration is given to the various methods of machining uranium monocarbide and a comparison is given in the case of their application to uranium carbide obtained by fusion under an electronic bombardment and continuous casting. This study leads to proposals for two mechanical machining methods: cylindrical rectification and centerless rectification, preceded by a preliminary roughing out of a cylinder, the latter appearing more suitable. A study of the machining yields as a function of the diameter of the rough bars and of the diameter of the finished rods has shown that an optimum value of the rough bar diameter exists for each value of the finished rod diameter. It is found that the yield increases as the diameter itself increases, this yield rising from 45 per cent to around 70 per cent as the diameter of the rough bars increases from 25–26 mm to 27–38 mm. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-34188# New Mexico State Univ., University Park. Research Center.
RESONANCE ABSORPTION OF ALPHA-POLARIZED COHERENT RADIATION BY PINK RUBY
R. C. Mitchell (Ph.D. Thesis) May 1966 90 p refs
(Contract Nonr-3531(04); Proj. Defender)
(TR-4; AD-633954) CFSTI: HC $3.00/MF $0.75

The R_1 absorption doublet in pink ruby has been studied near 90° K, using alpha-polarized incident radiation with both coherent and incoherent sources. A 2-inch ruby laser was used as the coherent source. Frequency scanning was accomplished by varying the relative temperatures of source and sample. Incoherent light measurements were made with a one-meter Ebert spectrometer using a zirconium-arc source. Careful measurements were made of the wave-length separation of the $R_1(1/2)$ and $R_1(3/2)$ components, in the laser source, as well as the separation of the longitudinal modes in each component. The component spacing was found to be 0.3829±.0004/cm and the mode separation was 0.0397/cm. The maximum values of absorption coefficient, using white light, were 10.7/cm for $R_1(3/2)$ and 6.8/cm for $R_1(1/2)$. Absorption on coefficients corresponding to coincidence of the laser output with the centers of the corresponding lines in the sample varied between 9 and 3/cm depending on the intensity and degree of plane-polarization of the beam. Author (TAB)

N66-34232# TRW Systems, Redondo Beach, Calif. Quantum Physics Lab.
HIGH INTENSITY LASER PROPAGATION IN THE ATMOSPHERE Semiannual Technical Summary Report, 1 Nov. 1965–30 Apr. 1966
Saul Altshuler, Lee M. Frantz, and Theodore D. Holstein 27 May 1966 33 p refs
(Contract N00014-66-C0022; ARPA Order 306; Proj. Defender)
(TRW-4535-6003-RO-000; AD-634316) CFSTI: HC $2.00/MF $0.50

Atmospheric heating by laser pulses in transmission windows has been investigated. Arguments are given for reducing previously given estimates for the absorption in the neighborhood of 10,468°A by nearly one order of magnitude. A study has been initiated of an additonal heating mechanism not previously considered, namely collision-induced conversion of laser energy into energy of translational molecular motion. A discussion is given of a classical model and of extensions to a quantum mechanical description. Author (TAB)

N66-34235# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DETERMINATION OF THE LOSS PARAMETERS OF A RUBY QUANTUM GENERATOR
B. I. Stepanov, A. N. Rubinov, and S. A. Mikhnov 16 Mar. 1966 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 9, no. 6, 1965 p 367–371
(Contract NOw-62-0604-c)
(TR-230-T468; TT-66-61390; AD-633624) CFSTI: HC $1.00/MF $0.50

Experimental methods for determining the basic parameters characterizing radiation losses in a ruby laser in a resonator with plane mirrors are outlined, using theoretical concepts developed by the authors in earlier papers. The method is based on determination of the scattering coefficient by measurement of energy level populations during generation. The population of the metastable level, studied with the aid of $\log (T/T^*) = \sigma n_2 l$ (T and T* are transmittances with and without pumping, resp.), indicates that saturation occurs somewhat later than the onset of generation and is independent of the pumping power. The variation in population is attributed to crystal inhomogeneity. Mathematical formulas are given for determining the loss relative to the population and to the transmittance efficiency of the noise radiated by the ruby surface. Author (TAB)

N66-34267# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
CONSIDERATION OF THE SPLITTING OF THE METASTABLE LEVEL OF A THREE-LEVEL QUANTUM GENERATOR

B. I. Stepanov and V. P. Gribkovskii 14 Mar. 1966 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR, v. 7, no. 5, 1963 p 305–308
(Contract NOw-62-0604-c)
(TR-230-T-467; AD-634231)

Previous theoretical studies of a three-level laser have not taken into account the fact that in real materials the metastable level is split. A more rigorous treatment is presented here, considering the ruby laser as a four-level system and using the transition probabilities and particle distribution functions to derive the conditions for steady-state oscillation. Factors favoring transition from one or the other of the two metastable sub-levels to the ground state are examined in detail, and the requirements for establishing oscillation separately at either of the two levels are obtained. If the probabilities of particle redistribution between the components of the metastable level are small as compared to the probabilities of descent of excited particles into the metastable state, then simultaneous oscillation at both frequencies is possible. Author (TAB)

N66-34543# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

THEORY OF A CIRCULAR DIELECTRIC RESONATOR

A. M. Goncharenko and B. A. Sotskii 20 May 1966 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR, v. 9, no. 4, 1965 p 224–227
(Contract NOw-62-0604-c)
(TG-230-T465; AD-634248) CFSTI: HC $1.00/MF $0.50

The properties of finite cylindrical dielectric resonator are discussed. The electromagnetic field of an infinite cylindrical resonator, both in the resonator and in the surrounding medium, is expressed in the form of cylindrical waves satisfying the boundary conditions. The electromagnetic field of a finite cylindrical resonator can be determined only inside the cylinder; the field is expressed as cylindrical waves traveling forward and backward along the cylinder axis. Attempts to use known functions to find the field in the surrounding medium are unsuccessful. But if the field inside the cylinder is known and the continuity of the normal energy flux components across the interface of the media is taken into account, the energy of individual natural oscillations, as well as the losses through the sides and ends of the cylinder, and the total energy stored in the cylinder, can be estimated. General formulas for these quantities have been derived. Author (TAB)

N66-34634*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

MEASUREMENTS OF SATELLITE RANGE WITH A RUBY LASER

C. G. Lehr, L. A. Maestre, and P. H. Anderson 13 May 1966 38 p refs *Its* Spec. Rept.-211
(Grant NsG-87-60)
(NASA-CR-77292) CFSTI: HC $2.00/MF $0.50 CSCL 20E

Range measurements on the GEOS-I and BE-C satellites were made with an experimental optical radar located at the Smithsonian astrophysical observing station. The radar's transmitter was a pulsed ruby laser. The receiver incorporated a time-interval counter with an accuracy of ±10 nsec, which gives a resolution of ±1.5 m. The most distant range measured was 2.6 Mm. The signals returned from the retroreflecting satellites were more than 16 dB below the values predicted by the radar-range equation. The measured ranges were compared with values obtained from orbits computed with field-reduced data of the Baker–Nunn observing stations. The measured and computed ranges were consistent to within a few hundreds of meters, the error that might be expected in the field-reduced orbits. Author

N66-34774# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

DISTRIBUTION OF PUMPING RADIATION DENSITY IN TRIHEDRAL ROD

F. K. Rutkovskii and T. K. Gur'yanova 20 May 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR, v. 9, No. 6, 1965 p 364–366
(Contract NOw-62-0604-c)
(TG-230-T476; AD-634245) CFSTI: HC $1.00/MF $0.50

The distribution of pump radiation density in a regular trihedral prism laser resonator is investigated by the methods of geometrical optics, using an expression derived previously for a rectangular prism. The problem of determining the path of a multiply reflected beam is set up geometrically for handling by a computer. Conditions under which the relative pumping density differs from zero are derived in terms of the fresnel reflection coefficients of the rod, and are shown graphically as functions of reflectivity and location within the rod. The pumping density is uniformly distributed for zero reflectivity and decreases toward the center of the rod for finite reflectivity. An expression is given for the ratio of energy absorbed in the rod to incident energy. Author (TAB)

N66-34884# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

THE RADIATION POWER OF GAS OPTICAL QUANTUM GENERATORS (LASERS) WITH PLANE MIRRORS AS A FUNCTION OF THE MIRROR MISALIGNMENT ANGLE

B. I. Stepanov and A. P. Prishivalko 20 May 1966 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR, v. 9, no. 7, 1965 p 432–434
(Contract NOw-62-0604-c)
(TG-230-T474; TT-66-61492; AD-634247) CFSTI: HC $1.00/MF $0.50

The problem of field distribution and diffraction losses in resonators with tilted and curved mirrors is treated in the geometrical optics approximation, which has been shown to be valid for consideration of the integrated radiation power. A solution is given for resonators with nonreflecting lateral surfaces, which have properties similar to those of gas lasers. Losses through the lateral surfaces are shown to have a greater effect on the radiation power than diffraction losses. With absolutely plane end plates, the radiation power is extremely sensitive to very slight misalignment; in practice the sensitivity is much lower because of the less than perfect surface quality. The effect of surface quality is considered in terms of a set of concave areas oriented at random small angles and expressions are derived for the radiation power as a function of the surface quality. Agreement with experiment is satisfactory, making the method useful for approximate calculations, if diffraction losses are also considered. Author (TAB)

N66-35061# Kollsman Instrument Corp., Elmhurst, N. Y.

LASER APPLICATION AVIATION ORDNANCE STUDY

Mark Steinhacker Port Washington, N. Y., Naval Training Device Center, Mar. 1966 132 p refs
(Contract N61339-1867)
(NAVTRADEVCEN-1867-1; AD-634917) CFSTI: HC $4.00/MF $1.00

A laser system applicable to airborne and ground weapon simulation training missions was developed and demonstrated. A full range weapon simulation system was designed in sufficient detail to allow fabrication of a demonstration system. The laser head assembly of this system, which is an yttrium aluminum garnet (YAG) unit operating at 1.065 microns and ten pulses per second continuous, was subjected to complete operational environmental tests. It was demonstrated to be

capable of exceeding the requirements of MIL-E-5400, MIL-E-5272, MIL-STD-810. The unit was shown to operate under longitudinal shocks of 650 g's. A self-contained silicon photodetector operating at maximum range signal levels was used to monitor all tests. Eye safety was thoroughly investigated and safe operational procedures are given. Recommendations for future laser weapon simulator effort are included. Author (TAB)

N66-35090# Michigan Univ., Ann Arbor.
AIRBORNE INVESTIGATIONS OF CLEAR AIR TURBULENCE WITH OPTICAL RADAR Progress Report
P. A. Franken, J. A. Jenney, and D. M. Rank Dec. 1965 175 p refs
(Contract Nonr-1224(51))
(AD-635030) CFSTI: HC $5.00/MF $1.00

The program was initiated to explore the possibility that characteristic optical radar echoes might actually be correlated with clear air turbulence. A light twin engine airplane was equipped with a laser radar and ancillary equipment for monitoring acceleration, temperature variations, and relevant meteorological data. The design of this equipment and the development of the flight programs was predicated on theoretical considerations of optical scattering from particulate matter. Author (TAB)

N66-35096# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
TECHNIQUES FOR SUPER-MODE OSCILLATION Interim Engineering Report, 1 Mar.–31 May 1966
Russell Targ [1966] 34 p refs
(Contract AF 33(615)-2884)
(IER-4; AD-635399) CFSTI: HC $2.00/MF $0.50

By means of a frequency selective coupler, more than 50 percent of the multimode power of a He–Ne laser was obtained at a single frequency. The amplitude stability of this single-frequency output was strongly dependent on the behavior of the power stabilization system used to control the positions of the laser mirrors. 28 MW of single-frequency light was obtained from a 50 MW He–Ne laser using the stabilization system described in the previous report. One of the limitations on the use of the super-mode technique is the very high peak-phase deviation ratio (Γ) that results from the operation of high-power FM lasers. Recently we have been able to operate at FM He-Ne laser with an internal phase perturbation driven at twice the axial mode interval of the laser cavity. The result of this 2(C/2L) excitation is an FM laser with approximately half the usual number of driven modes and thus half the modulation index to be un-modulated by the super-mode modulator. The preliminary design for the control system to absolutely stabilize the frequency of the FM laser has been completed. TAB

N66-35122# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
DESIGN STUDY OF LASER RADAR FOR DETECTION OF CLEAR AIR TURBULENCE Final Report, 1 Apr. 1965–15 Apr. 1966
Robert C. Breece, David L. Fried, and Raymond A. Munick Jun. 1966 170 p refs
(Contract AF 19(628)-5135)
(SID-66-450; AFCRL-66-364; AD-634886) CFSTI: HC $5.00/MF $1.00

The objective of the research was to perform a design study and feasibility demonstration of a Doppler laser radar system for use in detection of clear air turbulence. Both CW and pulsed radar techniques were investigated to determine applicability to analysis of laser light backscattered from atmospheric molecules and aerosol particles in order to measure macroscopic motion of the air. It was desired to detect wind gusts in excess of 25 feet per second while operating in a jet aircraft at an altitude of approximately 30,000 feet. The program included analysis of design requirements, analysis of light scattering by the atmosphere, a design trade-off study, and an experimental demonstration. It was concluded that, if particulate matter exists at flight altitudes in sufficient concentration and if advances in the laser state of the art permit fabrication of a laser with the required performance, a system with a range of up to 50 nautical miles is feasible. The analysis showed that the system must depend on scattering from aerosol particles and that a pulsed system has significant advantages over a CW system. A system concept is described which employs detection of beat frequencies in the output current of a photodetector resulting from photo-mixing of the backscattered light from two laser pulses illuminating separated volumes of air. An experimental demonstration was attempted which optically combined the light scattered from two streams of smoke moving at different velocities. The scattering volumes were illuminated by focusing the expanded output beam of an argon laser. Author (TAB)

N66-35171*# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.
LASER COMMUNICATION SATELLITE EXPERIMENT (LCSE)
Herbert F. Wischnia 1 Jul. 1966 176 p refs *its* Rept.-8399
(Contract NAS8-20115)
(NASA-CR-77462) CFSTI: HC $5.00/MF $1.25 CSCL 20E

Equipment for the Laser Communication Satellite Experiment (LCSE), and experimental procedures for the experiment are described. Also described are the functions of the LCSE laser/telescope; Apollo Spacecraft modifications for the LCSE; and technical requirements and parameters for components of the LCSE. Calculations of the expected power requirements for the space-to-earth communication link are presented. Information is also given for Ground Station PCM/PL receiver and tracker; and types of data to be developed from the experiment are discussed. The pre-flight, in-flight, and post-flight time requirements allotted the astronauts are outlined, along with a cost and schedule summary. Data tables and curves, and illustrative diagrams relating to the LCSE are included. L.S.

N66-35245*# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.
LASER/OPTICS TECHNIQUES Summary Report
Morley S. Lipsett 29 Apr. 1966 257 p refs *its* Eng. Rept.-8387
(Contract NAS8-20115)
(NASA-CR-77482) CFSTI: HC $6.00/MF $1.50 CSCL 20E

Laser and optical techniques applicable to future deep space optical communication systems are discussed. Analysis and laboratory work have been conducted in the following areas: stability of laser beam intensity distribution in the far field; remote boresight alignment of receiving and transmitting optical channels; isolation of the transmitter channel from the receiver channel; determination of a rotational coordinate reference system about the line of sight; and ways of implementing fine guidance tracking and pointing offset capabilities. Laboratory breadboard equipment, which was developed as building blocks, is described, and a summary of project activities to date is presented. Fluctuations in the far field of a He–Ne laser are shown to be of

insufficient magnitude to be detrimental to an optical communication link. Further, it is shown that, by special dielectric multilayer filter techniques, channel isolation of at least 115 dB is readily achieved for the purpose of optical duplexing. Author

N66-35301# United Kingdom Atomic Energy Authority, Culham (England). Research Group.

CO-OPERATIVE SCATTERING OF LASER LIGHT BY A THETATRON PLASMA

D. E. Evans, M. J. Forrest, and J. Katzenstein Apr. 1966 11 p refs Submitted for Publication

(CLM-P-104) CFSTI: HC $1.00/MF $0.50

Frequency distributions of ruby laser light scattered on the MAGGI II thetatron plasma have been measured under conditions in which the ratio of correlation length to Debye length, α, was between 1.2 and 1.5. This regime is important diagnostically because both electron temperature and electron density can be calculated from the shape of the spectrum, without having recourse to a subsidiary Rayleigh scattering experiment. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-34087# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

HIGH TEMPERATURE REACTOR MATERIALS RESEARCH

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 21–62 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Physical and mechanical properties of commercially available refractory materials are evaluated for use in fueled and non-fueled reactor applications at temperatures of 1000 to 3000°C. Transition temperature for the creep mechanisms in tungsten was found to be 2000°C when stress-rupture and creep characteristics for arc-cast tungsten were studied at 1000 to 3000°C in hydrogen with rupture times of one to 250 hours. Apparent activation energy for creep of arc-cast tungsten from 2000 to 2800°C was found to be 160 kcal/mole. Rupture life for arc-cast tungsten and molybdenum is found to be the same. Creep-rupture evaluations of numerous samples of W-25Re sheet performed at 1600 and 2000°C indicate wide variation in times to produce the same strain values. Of the various refractory metals and alloys evaluated at 1600°C, W-25Re has the greatest rupture strength and unalloyed molybdenum the least. Details of the evaluation of many of the materials are included, along with photomicrographs and graphs which show the results of the studies. M.W.R.

N66-34088# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

EFFECT OF RADIATION ON REFRACTORY METALS

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 63–98 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Radiation effects on the time, temperature, and stress dependent properties of refractory metals and alloys were investigated. Studies on W-25Re showed that neutron radiation (3.4×10^{19} nvt) at reactor ambient temperature increases rupture life. At 900°C there was a slight increase for a commercially produced alloy, and at 850°C an increase of about a factor of 20 was observed in the GE-NMPO-produced alloy. Ductility of both alloys was not significantly affected by irradiation, and annealing studies at 1700°C showed that only partial recovery occurred. The same radiation dose at reactor ambient temperatures does not significantly change the creep rupture properties of Mo-0.5Ti-0.08Zr. Tensile properties of neutron-irradiated tungsten specimens at test temperatures of 240°C show an increase in strength with an increase in annealing temperatures up to about 750°C. Rapid recovery occurs above this temperature, and at 1050°C there is almost complete recovery. Ductility indices are low at all annealing temperatures except over 1050°C. Results are also reported for resistivity, hot-hardness, and transmutation studies. M.W.R.

N66-34090# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

REFRACTORY-METAL ALLOY RESEARCH AND DEVELOPMENT

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 109–133 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Consideration is given to the development of new refractory metal alloys, particularly on composition within the W–Re–Mo ternary system, which will improve the temperature and life capabilities of nuclear power plants. A wide range of alloy compositions were shown to be available for high temperature reactor programs; and a good deal of effort was devoted to trial production runs of W-25Re-30Mo and W-30-Re-30Mo alloys as sheet, rod, plate, and a seamless tubing. Tubing of both of these was successfully drawn over stationary carbide mandrels with the work piece heated to 200°C in hot oil. The low drawing temperature prevents tube contamination. Purification treatments aimed at lowering carbon and oxygen content improved the weldability and ductility of Mo. Small-diameter seamless tubing was fabricated from W-5Re alloy whose melting point is estimated to be 3370°C; and this alloy is being considered as a substitute for unalloyed W for very high temperature service. Creep-rupture tests at 200°C showed arc-cast W-25Re to be more deformation resistant in the low strain region than comparable metallurgy process sheet. M.W.R.

N66-34093# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

EFFECT OF RADIATION ON HEAT RESISTANT METALS AND ALLOYS

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 169–184 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Radiation effects are being investigated on time-, temperature-, and stress-dependent properties of heat-resistant metals and alloys at elevated temperatures; and emphasis is placed on post-irradiation creep-rupture and tensile property measurements. Reduction in creep-rupture life of Hastelloy N specimens tested at 650°C appears to be independent of irradiation temperature; and welded Hastelloy N has a creep-rupture life which is about one-tenth that of unwelded material. In irradiated iron-base precipitation hardening alloys, specimens containing the least amount of boron have the greatest reduction in creep-rupture properties for both ambient and 650°C irradiation temperatures. M.W.R.

N66-34094# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

EVALUATIONS OF THE PLASTIC FATIGUE PROPERTIES OF HEAT RESISTANT ALLOYS

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 185–201 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

One hydraulic fatigue machine was placed in operation in a newly-established fatigue laboratory in order to study the parameters affecting low-cycle fatigue behavior of metals and alloys at elevated temperatues and to generate data for use in the design of structural components of high-performance nuclear reactor systems. Experimental procedures were developed for high temperature uniaxial fatigue testing with push–pull loading and diametral strain control. An exploratory program demonstrated ability of the program to generate accurate and reproducible low-cycle fatigue data for heat-resistant alloys, and systematic testing of Type 304 stainless steel was begun. M.W.R.

N66-34124# Franklin Inst., Philadelphia, Pa. Research Labs.

THE MICROSTRAIN REGION IN HIGH-PURITY REFRACTORY METALS First Quarterly Report, Mar. 1–May 31, 1966

H. L. Prekel, A. Lawley, and J. D. Meakin [1966] 32 p refs

(Contract Nonr-4434(00))

(Q-B2195-1; AD-634128) CFSTI: HC $2.00/MF $0.50

Modifications to a conventional electron beam floating zone unit are described. The filament is hidden from the specimen and this results in increased stability of operation, longer filament life, and excellent uniformity of crystal diameter (0.130"±0.001"). Molybdenum single crystals grown from vacuum arc-cast and hot swaged stock contain inclusions, and the crystals exhibit a high grown-in dislocation density $\sim 6\times10^{7}cm^{-2}$; 90% of these dislocations are associated with and are attributable to the inclusions. Variations in zoning speed, number of zone passes, and annealing treatments at 1700°C in vacuum or in argon have no appreciable effect on the number of inclusions. The inclusions are effectively removed from zoned crystals by annealing in hydrogen at about 2000°C; this is accompanied by a decrease in dislocation density to $\sim 10^{6}cm^{-2}$. Hydrogen annealing of the as-received material followed by zone melting gives inclusion-free crystals, and a dislocation density $\sim 4.5\times10^{6}cm^{-2}$; a further hydrogen anneal after zone melting reduces the density to $\leq 2\times10^{6}cm^{-2}$. Preliminary dislocation velocity experiments are described. The basic relations in mechanical hysteresis were reexamined. Author (TAB)

N66-34277# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

MOSSBAUER EFFECT IN IRON–CARBON AND IRON–NITROGEN ALLOYS

P. M. Gielen and Roy Kaplow 20 Apr. 1966 63 p refs

(Contract Nonr-1841(38))

(AD-633725) CFSTI: HC $3.00/MF $0.75

Interstitial solid solutions of carbon and nitrogen in iron were analyzed by Mossbauer spectroscopy. In both allotropic forms, austenite (gamma) and martensite (alpha), electric quadrupole effects were observed. Arising from a repopulation of electrons among the d-orbitals of iron atoms adjacent to the interstitial atoms. In carbon austenite, the quadrupole effect of $e^2qQ/2=0.625$ mm/sec for iron atoms which are first neighbors of carbon atoms. In nitrogen–austenite, the quadrupole effects are smaller but an appreciable positive isomer shift is observed for iron atoms which are first neighbors of nitrogen atoms. This suggests that these iron atoms have more d-electrons due to some covalent bonding with nitrogen as exists in the isomorphous Fe_4N-phase. Carbon shows a positive and nitrogen a negative ion behavior in both martensite and in austenite. The C-axis is a direction of difficult magnetization in both Fe–C and Fe–N martensites.

Author (TAB)

N66-34317*# Battelle Memorial Inst., Columbus, Ohio.

AN INVESTIGATION OF THE REACTION OF TITANIUM WITH HYDROGEN Summary Report

B. G. Koehl, W. Hodge, and D. N. Williams 14 Jul. 1966 49 p refs

(Contract NAS9-5298)

(NASA-CR-65456) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The investigation was to determine whether titanium and titanium alloys could be made to react consistently with hydrogen at low temperatures and low to medium pressures. The work was undertaken in three phases. Unstressed specimens were sealed in stainless steel reactors, annealed, and then pressurized in an H_2 environment and held for periods of from 10 to 1000 hours at controlled temperatures during the first phase. During the second phase, stressed specimens were exposed with and without concurrent stress at 300°F in a hydrogen environment under 315 psia. During the third phase, unstressed specimens were enclosed in a glass vacuum system capable of maintaining pressures on the order of 0.05 micron or less at room temperature and atmospheric pressure. An analysis of the chemical and mechanical properties of the materials is given. Experimental methods and equipment are described in detail, and the results are presented in tabulated form. K.W.

N66-34398# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE RELATIONSHIP BETWEEN DAMPING PROPERTIES AND CERTAIN STRENGTH CHARACTERISTICS OF A CARBON STEEL

V. I. Shashlov *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 184–188 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Carbon content or mode of heat treatment do not appear to affect the logarithmic damping decrements of various carbon steels subjected to identical stresses. The internal energy dissipation is attributed to microplastic deformations which occur in the material during cyclical loading. M.W.R.

N66-34523# Metals and Controls, Inc., Attleboro, Mass.

STUDY OF DUCTILE COATINGS FOR THE OXIDATION PROTECTION OF COLUMBIUM AND MOLYBDENUM ALLOYS Final Report, 1 Mar. 1965–28 Feb. 1966

Henry F. Breit, John F. Clarke, and Edward H. Girard May 1966 45 p refs

(Contract NOw-65-0340-f)

(AD-634402) CFSTI: HC $2.00/MF $0.50

Nine materials were examined as potential barriers to the degrading diffusion of elements from FS-85 and TZM substrate through platinum coatings. One metal, hafnium, and one binary combination, iridium clad tungsten, were particularly effective as diffusion barriers. However, the increase in coating life produced through usage of these metals was no more than would be expected with a similar increase in coating thickness, coating lives of up to 66 hours were obtained at 2550°F in flowing air. It appears that when formed under the proper conditions, platinum–molybdenum and platinum–columbium intermetallic compounds may act as barriers to coating-substrate interdiffusion. Their usefulness in extending coating life should be explored further. Author (TAB)

N66-34524# Nuclear Metals, Inc., West Concord, Mass.
STUDY OF DISPERSION-STRENGTHENED ALLOYS PRODUCED BY SLIS TECHNIQUES Final Report
A. R. Kaufmann, W. C. Muller, and R. B. Russell 1 Jun. 1966 88 p refs
(Contract NOw-65-0386-f)
(NMI-8002.4; AD-634384) CFSTI: $3.00/MF $0.75

Alloys of nickel with Mg, U, Y, La, Gd, and Er were prepared by splatcooling and the growth rates of the precipitates were determined at various temperatures. In all cases the growth appears to be determined by a diffusion-controlled process. A qualitative correlation of decreasing growth rate with increasing melting point of the intermetallic compound was obtained for the Mg, U, and Y alloys, but this interpretation is not clear cut. The maximum solid solubilities of La, Gd, and Er in Ni are less than 150 ppm, but exact values could not be obtained. The compounds formed by La and Er have outstanding particle size stability at temperatures up to 1150° C. This behavior must be at least partly attributable to the low solid solubility. The stability of the nickel–rare earth compounds is comparable to the of Al_2O_3 in nickel. Author (TAB)

N66-34536# Massachusetts Inst. of Tech., Cambridge. Welding Lab.
MECHANICAL AND METALLURIGICAL BEHAVIOR OF RESTRAINED WELDS IN SUBMARINE STEELS Final Report
Clyde M. Adams, Jr. and D. A. Corrigan May 1966 82 p refs
(Contract NObs-92077)
(AD-634747) CFSTI: HC $3.00/MF $0.75

The study was made to develope a greater understanding of the thermomechanical aspects of the fusion welding process, particularly the dynamics of residual stress development and its significance in the cracking of HY-130/150 steel. A method was developed by which the residual stress distribution in and near a weld can be completely and accurately determined. Weldment residual stresses can be obtained rapidly and economically using only standard strain measuring and machining techniques. Three different plate materials, HY-130/150, HY-80, and 12% maraging steels, were studied. The nominal base metal yield strength varied from 80,000 to 175,000 psi. In HY-80 weldments the maximum residual stresses are longitudinal and of the order of the base metal yield strength. They were a maximum at the weld centerline. In HY-130/150 and 12% Ni maraging steels, the maximum tensile stresses are again in the direction of welding. The maximum stress values occur, however, in the weld heat-affected-zone, far removed from the fusion line. Extremely high stress gradients were present in these regions. The observation that weldment residual stresses may be a maximum in regions other than the deposit has apparently not been reported before. An explanation of alloy-to-alloy differences based on the relative temperatures of hot plastic deformation and austenite transformation is proposed. Author (TAB)

N66-34597# Titanium Metals Corp. of America, Toronto, Ohio.
THE EFFECT OF DEFORMATION PROCESSING ON THE MECHANICAL PROPERTIES OF Ti-6Al-4V FOR ARMOR Final Technical Report
Dwayne L. Day, Roger G. Broadwell, and Joseph L. Sliney (Army Mater. Res. Agency) Jun. 1966 96 p refs
(Contract DI-19-066-A4-05852(Z))
(AMRA-CR-66-06(F); AD-635482) CFSTI: HC $4.00/MF $0.75

An investigation was made to delineate the effects of deformation processing at variable interstitial content, and thermal treatment on the laboratory mechanical properties and ballistic performance of 5/8 in. thick Ti-6Al-4V armor plate. Attempts were made to correlate the effects of laboratory fracture toughness test with ballistic data. In total, this analysis tried to confirm the primary, chemical and metallurgical effects as noted above under the controlled conditions of a systematic study. Author (TAB)

N66-34653*# ManLabs, Inc., Cambridge, Mass.
ANALYSIS OF VAPORIZATION OF LIQUID URANIUM, METAL, AND CARBON SYSTEMS AT 9000° AND 10,000°R
L. Kaufman and E. T. Peters Washington, NASA, Sep. 1966 49 p refs
(Contract NAS3-8036)
(NASA-CR-591) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A thermodynamic analysis of the tungsten–carbon–uranium (W–C–U) system was performed to determine its capability as a heat exchanger for hydrogen gas at 100 atm pressure and temperatures between 8000° to 10,000°R. The vapor pressures over various liquid alloys of W–C–U, and the average molecular weight of W–C–U–H mixtures were calculated, and results indicate that the W–C–U system yielded lower gas molecular weights than the zirconium and niobium systems previously studied. The calculation of congruencies for metal–carbon–uranium ternary systems is shown, and mass loss rates through hydrogen transport and vaporization are estimated. The vapor–liquid–graphite triple point for carbon is considered, and the interaction parameters calculated for the W–C–U ternary system are also presented. A.G.O.

N66-34694*# Batelle Memorial Inst., Columbus, Ohio.
A STUDY OF HYDROGEN EMBRITTLEMENT OF VARIOUS ALLOYS Annual Summary Report, 24 Jun. 1965–23 Jun. 1966
T. P. Groeneveld, E. E. Fletcher, and A. R. Elsea 23 Jun. 1966 50 p refs
(Contract NAS8-20029)
(NASA-CR-77374) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Hydrogen-stress-cracking experiments, hydrogen-entry-rate experiments, and hydrogen analyses were performed on alloy specimens cathodically charged under standard conditions. Comparison of the data revealed no simple direct correlation between hydrogen-entry-rate and susceptibility to hydrogen-stress-cracking. The results of the analyses suggested that hydrogen distribution within the sample is more important than average hydrogen content in determining susceptibility to failure. The hydrogen-stress-cracking behavior of notched tensile specimens, which had been cleaned and electroplated in cadmium cyanide baths with and without brighteners, were evaluated. It was found that preplating cleaning introduced sufficient hydrogen to cause embrittlement in some alloys but, in general, the plating process itself introduced more hydrogen than did the cleaning process. E.N.

N66-34696*# Case Inst. of Tech., Cleveland, Ohio. Dept. of Metallurgy.
EFFECTS OF HYDROSTATIC PRESSURE ON THE MECHANICAL BEHAVIOR OF BODY CENTERED CUBIC REFRACTORY METALS AND ALLOYS Interim Technical Report No. 4, 1 Jun. 1965–1 Jun. 1966
S. V. Radcliffe, G. Das, and P. Trester Jun. 1966 45 p refs
(Grant NsG-654)
(NASA-CR-77383) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The influence of the volume proportion of second-phase particles on the decrease in flow stress for a series of annealed iron-carbon alloys after subjection to a hydrostatic pressure

of 20 kilobars has established that the maximum change occurs for alloys containing 1 to 2 vol.% for the particular morphology used. The existence of an increase in the minimum or critical pressure for the development of pressure-induced changes in yield behavior with increase in volume of second phase is indicated. Measurements of tensile ductile-brittle transition behavior for fully recrystallised commercial purity tungsten and tungsten-1 wt.% thoria alloy after subjection to a hydrostatic pressure of 20 kilobars show no change in transition temperature, within the accuracy of measurement, from that of the as-recrystallised materials. Author

N66-34703*# Aluminum Co. of America, New Kensington, Pa. Physical Metallurgy Div.

STUDY OF CRACK INITIATION PHENOMENA ASSOCIATED WITH STRESS CORROSION OF ALUMINUM ALLOYS Literature Survey

M. S. Hunter, E. H. Hollingsworth, R. L. Horst, and John Mc Hardy 5 Aug. 1966 38 p refs

(Contract NAS8-20396)

(NASA-CR-77361) CFSTI: HC $2.00/MF $0.50 CSCL 11F

This survey encompassed 74 references to the literature on the phenomena of stress-corrosion cracks in metals, particularly aluminum aloys. Since most of the literature did not distinguish between the stages of initiation and propagation, the survey is devoted to the whole process rather than to the initiation stage alone. Possible mechanisms and factors affecting stress-corrosion cracking are cited and environmental effects are assessed. H.S.W.

N66-34709# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

CRYSTALLOGRAPHIC STUDY AND SELF-IRRADIATION EFFECTS OF PLUTONIUM AT LOW TEMPERATURE [ETUDE CRISTOLLOGRAPHIQUE ET EFFETS DE L'AUTOIRRADIATION SUR LE PLUTONIUM A BASSE TEMPERATURE]

Pierre Solente (Ph.D. Thesis—Paris Univ., 10 Nov. 1964) May 1965 57 p refs In FRENCH

(CEA-R-2735)

The variation of the lattice parameters of α-Pu and delta-stabilized Al–Pu alloys was measured at low temperatures to verify the existence of an antiferromagnetic transition. The effects of alpha particles on the length of polycrystalline α-Pu were studied at 4.2°K. No crystallographic changes from the structure of α-Pu at room temperature were noted at 18°K. The thermal expansion coefficients along the 3 axes appeared positive at 18°K, therefore, the magnetic contribution to the thermal expansion coefficient must be small. A dilatation anomaly and an anomaly of the diffraction line intensity were observed for δ-Pu at 100°K. No substructure lines were observed at 20°K. The length of α-Pu increased with time at a rate of 5×10^{-6}/hr when held in liquid He. This effect is attributed to the creation of Frenkel pairs. NSA

N66-34732# Brookhaven National Lab., Upton, N. Y.

THE MOBILITY OF DISLOCATIONS NEAR THE DUCTILE TO BRITTLE TRANSITION TEMPERATURE IN IRRADIATED IRON

S. B. Mc Richard [1965] 16 p refs Presented at Symp. on Radiation Effects, Asheville, N. C.

(Contract AT(30-2)-GEN-16)

(BNL-9263; CONF-650904-10) CFSTI: HC $1.60/MF $0.50

Fast neutron irradiation has been shown to increase the yield and flow stresses of iron and also to produce a transition from ductile to brittle behavior in tension near 125°K. A study of the effects of temperature and irradiation on dislocation kinetics near the yield point was performed to provide information on the above behavior. The variation of dislocation velocity with applied stress was studied at different temperatures before and after irradiation using a stress relaxation technique. The exponent m in the equation relating velocity and stress was found to equal approximately 20 for the initial Luder's band extension until the temperature is lowered below approximately 150°K where it begins to increase. Strain hardening also increases m. Irradiation increases m particularly at room temperature and then most sharply below the ductile to brittle transition temperature. However stress relaxation in embrittled iron below the extrapolated upper yield stress produced a delayed yield from which an m value equivalent to that just above the transition was calculated. The problem of ductile flow in the irradiated iron studied appears to be one of initiation of dislocation motion and the data seem to indicate a higher effective stress is required for dislocation motion in irradiated iron although the mechanism remains unchanged. Arguments are also presented that the assumption of a constant mobile dislocation density during stress or strain rate changes is not valid where m is found to increase sharply. Author (NSA)

N66-34777# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MECHANICAL PROPERTIES OF ALLOYS OF THE QUARTERNARY SYSTEM Nb–W–Mo–Zr AT TEMPERATURES OF 1000–1600°C

Ye. M. Savitskiy and A. M. Zakharov 21 Jan. 1966 22 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chern. Met. (Moscow), no. 1, 1965 p 104–109

(FTD-TT-65-1471; AD-634834) CFSTI: HC $3.00/MF $0.50

Translation of Russian research: Mechanical properties of alloys of the quarternary system Nb–W–Mo–Zr at temperatures of 1000–1600° C. TAB

N66-34804*# Little (Arthur D.), Inc., Cambridge, Mass.

THE PEST PHENOMENON IN INTERMETALLICS Quarterly Report

Joan Berkowitz and Michael Rossetti 28 Jul. 1966 9 p refs

(Contract NASw-1403)

(NASA-CR-77395) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Single crystal boules of molybdenum disilicide were prepared to perform static fatigue tests in order to correlate failure measurements in the so-called pest range with classical chemical kinetic measurements. The pest phenomenon refers to the powdery yellow oxide, a mixture of SiO_2 and MoO_3 which is observed on fracture surfaces. Since static fatigue curves must be obtained as a function of temperature, particular attention was given to controlling the base level strength of the crystals; and measurements made on four samples cut at random found this strength to be 51,000 ±3500 psi. M.W.R.

N66-34821# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF ALLOYING OF COPPER ON SEIZING IN CAPABILITY TEMPERATURES RANGE 23–450°

A. P. Semenov 12 Jan. 1966 26 p refs Transl. into ENGLISH from AN SSSR Inst. Mashinoved. Treniye Iznos v Mashinakh Sb. (Moscow), no. 15, 1962 p 227–253

(FTD-MT-65-28; AD-635278) CFSTI: HC $2.00/MF $0.50

To study more fully the influence of alloying on seizing capability and its connection with the mechanical properties of alloys, a study was made of a large number of copper alloys in the region of solid solutions. Seizing capability was determined according to joint plastic deformation of pairwise formed sheet samples by symmetrically slanted punches. Plotted curves represent the dependence of deformation magnitudes on pressures applied during deformation of the same

samples by flat narrow punches. The results of the investigation confirm that for copper alloys the dissolution of alloying components and the change of crystal lattice parameter are important indices of antifriction properties. Probably, analogous dependences can also serve as leading principles for the evaluation and creation of antifriction alloys. TAB

N66-34824# Marine Engineering Lab., Annapolis, Md.
THE EFFECT OF MINOR ALLOYING ADDITIONS ON THE SEA-WATER CORROSION BEHAVIOR OF ALUMINUM-BRONZE ALLOYS
R. E. Maersch Jun. 1966 20 p ref
(MEL-196/66; AD-635288) CFSTI: HC $6.00/MF $0.50

Some compositions of aluminum–bronze alloys suffer an insidious type of selective-phase attack in seawater. One proposed method to improve the corrosion behavior of these materials was the addition of minor alloying elements to promote the formation of microstructural consitutents that are electrochemically compatible. Three experimental alloys, containing small amounts of tin, nickel and arsenic, respectively, were analyzed after sea-water exposure. None of the minor alloying additions imparted significant improvement in corrosion behavior of the base alloy. Author (TAB)

N66-34864*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEDURES FOR EXTERNALLY LOADING AND CORROSION TESTING STRESS CORROSION SPECIMENS
T. S. Humphries 29 Jun. 1966 39 p refs
(NASA-TM-X-53483) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The procedures for externally loading various types of stress corrosion specimens and a description of the test specimens are presented. An accelerated corrosion test method which consists of alternate immersion in a 3-1/2 percent sodium chloride solution is also described. The types of specimens described and the methods of externally loading and corrpsion testing the specimens have been found to be reliable for stress corrosion evaluation of most aluminum alloys, and have shown promise for ferrous and nickel alloys. Author

N66-34925# Naval Boiler and Turbine Lab., Philadelphia, Pa.
CORROSION BEHAVIOR OF 16% CHROMIUM–1% NICKEL DESUPERHEATER ALLOY WHEN EXPOSED TO CHEMICAL DESCALANTS Final Evaluation Report
H. Meyer and J. A. Mc Kelvey 17 Jun. 1966 25 p
(AD-635368) CFSTI: HC $1.00/MF $0.50

An investigation was made to develop a suitable descalant formulation to permit chemical cleaning of 16% chromium–1% nickel (16-1 Croloy) desuperheaters, without deleterious effects. Based on bench studies, these elements can be descaled safely with the boiler scale removing compound (sulfamic acid, citric acid, diethylthiourea) containing an inhibitor supplement. In addition, this formulation may be used to descale boilers with the 16-1 Croloy desuperheaters intact. A full scale boiler cleaning operation should be initiated to confirm the successful bench scale findings. Author (TAB)

N66-34838*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF COLUMBIUM-MODIFIED NASA TAZ-8 SUPERALLOY
William J. Waters and John C. Freche Washington, NASA, Sep. 1966 24 p refs
(NASA-TN-D-3597) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The oxidation resistance of the NASA TAZ-8 alloy was substantially improved, and its workability potential and high-temperature strength characteristics were generally retained by replacing vanadium with columbium and by adding small quantities of boron. This modified version was designated TAZ-8A. The nominal composition of the alloy in weight percent is 2.5 columbium, 8 tantalum, 6 chromium, 6 aluminum, 4 molybdenum, 4 tungsten, 1 zirconium, 0.125 carbon, 0.004 boron, and the balance nickel. In the vacuum-melted condition after 310 hrs in air at 1900°F the alloy showed a weight gain of 1.8 milligrams per square centimeter. An argon-melted 0.0215-inch rolled-sheet oxidation specimen had a weight gain of 0.5 milligram per square centimeter after approximately 8 hours exposure at 1900°F. Substantially improved high-temperature oxidation resistance over other representative nickel-base alloys was observed in tests that measured weight gain and weight loss. The TAZ-8A alloy was hot rolled from cast strips 0.110-inch-thick to 0.020-inch strips on a conventional rolling mill. Such a reduction indicates at least limited workability potential. Author

N66-34945# Naval Research Lab., Washington, D. C. Metallurgy Div.
METALLURGICAL CHARACTERISTICS OF HIGH STRENGTH STRUCTURAL MATERIALS Ninth Quarterly Report, Aug.–Oct. 1965
R. J. Goode, R. W. Huber, D. G. Howe, R. W. Judy, Jr., P. P. Puzak et al Nov. 1965 104 p refs
(NRL-6405; AD-634094) CFSTI: HC $4.00/MF $0.75

The report includes fracture toughness studies on high strength steels, titanium alloys, and aluminum alloys. Fracture toughness index diagrams, modified to include the latest information, are presented for these materials: the effects of melting practice and processing variables are reflected in the fracture toughness index diagram for steels by the addition of a new optimum materials trend line for consumable-electrode-vacuum melting of steels. Results are presented for studies concerning (1) the use of side-grooved plane-strain fracture mechanics specimens for valid determinations of fracture toughness, (2) heat-treatment effects on fracture toughness of several titanium alloys, (3) the effect of vacuum heat treatment on stress-corrosion-cracking sensitivity of titanium, and (4) the screening of a variety of titanium alloy plates for sensitivity to stress-corrosion-cracking. The effects of mean strain on low-cycle fatigue crack propagation in 5Ni-Cr-Mo-V steel and 7079-T6 aluminum are presented, also described in a newly-developed low-cycle fatigue crack propagation test employing fracture mechanics parameters. Results are given for D6AC steels. TAB

N66-34978# Technion Research and Development Foundation, Ltd., Haifa (Israel).
RESEARCH ON SECOND ORDER EFFECTS IN THE ELASTIC RESPONSE OF METALS Annual Report, Jul. 1, 1965–Jun. 30, 1966
Markus Reiner (Israel Inst. of Tech.) [1966] 20 p refs
(Contract N62558-4482)
(AR-2; AD-635138) CFSTI: HC $6.00/MF $0.50

Using the Green, Almansi and Hencky measures of finite strain, the elastic response of a circular cylinder in torsion is calculated under the assumption that a change of length is prevented. It is found that this requires the application of axial pressures at the ends. Author (TAB)

N66-35010# Illinois Univ., Urbana Dept. of Theoretical and Applied Mechanics.
LOW CYCLE FATIGUE BEHAVIOR OF QUENCHED AND TEMPERED SAE 1045 STEEL

Jo Dean Morrow Apr. 1965 29 p refs Sponsored by Caterpillar Tractor Co., LaSalle Steel Co., and US Steel Corp.
(ITAM-277)

Monotonic stress-strain properties and axial fatigue results are reported for five high hardness levels of quenched and tempered SAE 1045 steel. Yield, ultimate, and true fracture strength and the completely reversed fatigue strength were found to go through a maximum value as the hardness increases. The optimum hardness for maximum strength was found to be approximately 630 Brinell. Deformations during stress cycling were shown to change depending on the initial hardness. At 630 BHN the same size and shape of hysteresis loop was obtained cycle after cycle. At lower hardnesses, extreme cyclic softening was observed. The as quenched or hardest condition cyclically hardened. The stress-life relation was shown to hold over the hardness region investigated with the fatigue strength exponent, varying only slightly between −0.07 and −0.08. The fatigue strength coefficient, was found to be approximately equal to the true fracture strength from the monotonic tension test. Attempts to relate fatigue life to plastic strain using the function $\Delta\epsilon_p/2=\epsilon_f(2n_f)^c$ were unsatisfactory because this plastic strain constantly increases when cyclic softening occurs under stress control making it difficult to select a representative value of $\Delta\epsilon_p$. Using terminal values of $\Delta\epsilon_p$, it was shown that the fatigue ductility exponent c of −0.5 does not fit the results. Instead, values of the exponent between −0.6 and −1 are obtained with the −1 value applying at high hardness. Author

N66-35022*# Case Inst. of Tech., Cleveland, Ohio.
MODIFIED EUTECTIC ALLOYS FOR HIGH TEMPERATURE SERVICE Second Year Interim Report, May 1965–Jun. 1966
S. F. Ramseyer and J. F. Wallace [1966] 78 p refs
(Grant NsG-639)
(NASA-CR-77385) CFSTI: HC $3.00/MF $0.75 CSCL 11F

The methods for control of cast structure, i.e., eutectic modification, grain refinement, and directional solidification, are described in detail. The techniques and theories of eutectic modification and structure refinement were then used to improve the properties of superalloys over those currently obtained with cast Ni-W and Co-W alloys; criteria were established to develop the desired as-cast structures; and variations in the as-cast structure were correlated with high temperature properties. It was shown, from the survey of both the Ni-W and Co-W systems, that the majority of binary alloys can be successfully modified by a single addition of 0.75-Ti-0.75Zr-0.5C–0.1B. The modified alloys had substantially improved stress rupture lives and ductility. In subsequent alloying of the base Co-35W alloy, it was found that additions of Ti, Zr, C, and Cr refined and modified the base structure and improved properties; however, Mo, V, Ta+Nb, and N_2 adversely influenced both structure and properties. Variations in the casting procedure were felt to have only minor influence on structure and high temperature properties. Generally, the improvement in properties was associated with a refinement of the dendritic structure and a change in the size and morphology of the microconstituents. L.E.W.

N66-35047*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRUCTURE AND PROPERTIES OF TUNGSTEN-BASE POWDER METALLURGY COMPOSITES
Thomas P. Herbell, John W. Weeton, and Max Quatinetz
Washington, NASA, Sep. 1966 52 p refs
(NASA-TN-D-3610) CFSTI: HC $2.50/MF $0.50 CSCL 11F

Tungsten and tungsten-base billets were prepared and extruded to determine the strengths of composites produced by promising powder metallurgy methods and to relate microstructure and other metallurgical parameters to these strengths. Two different types of tungsten-base composite powders were utilized. Both powder types as well as various combinations with tantalum powder were studied. Most of the materials exhibited 3000°F tensile and stress-rupture strengths that greatly exceeded those of unalloyed tungsten. Stress-rupture tests at 3500°F also indicated an appreciable strength advantage relative to tungsten. Strengthening occurred despite the fact that a uniform distribution of dispersoids was generally not achieved. Improved high-temperature properties were attributed in most cases to the combined effects of dispersoids and solid solution alloying. Materials showing particular promise were tungsten–5 volume percent hafnia, and tungsten–0.5 weight percent zirconium plus 5 to 15 weight percent tantalum. Tungsten–0.5 weight percent zirconium plus 5 weight percent tantalum was prepared with a two-phase structure. This material possessed good high-temperature strength properties and was easy to extrude. The strengthening was attributed to the presence of a two-phase structure (one tungsten rich, one tantalum rich) combined with a uniform distribution of fine dispersoids. Presumably the presence of the tantalum-rich phase aided in the extrusion of this material. Author

N66-35053# IIT Research Inst., Chicago, Ill. Technology Center.
VANADIUM ALLOY STUDIES Final Report, Mar. 1, 1965–May 31, 1966
R. D. Mc Gill and F. C. Holtz 29 Jun. 1966 36 p
(Contract NOw-65-0427-f)
(IITRI-B6042-5; AD-634827) CFSTI: HC $6.00/MF $0.50

Alloys based on V-20Cb and V-Cb-Ta, enriched in Ti, Si, and C were fabricated by arc-melting, hammer forging, and cold rolling to sheet or foil; the silicon and carbon additives promoted age hardening. The V-20Cb-10Ti base alloys were highly fabricable and had density-corrected strengths up to 1,300,000-in. at −320°F, 800,000-in. at 1200°F, and 250,000-in. at 1800°F. Somewhat reduced fabricability was noted for V-Cb-Ta base alloys which contained materials were to 54°V. The tantalum-containing materials were nearly as strong as the V-Cb-Ti alloys up to 1200°F, and they were much stronger in the 1800°F to 2400°F range. Density-corrected strengths were above 400,000-in. at 1800°F, and 160,000-in. at 2200°F. Improved workability but slightly reduced strengths (density-corrected) were noted in V-Cb-Ta alloys as vanadium contents were raised. TAB

N66-35064# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELASTIC–PLASTIC MATERIAL RESPONSE TO SUBMICROSECOND UNIAXIAL STRESS
Charles E. Harris (M.S. Thesis) Mar. 1966 299 p refs
(GSP PH/66-9; AD-635003) CFSTI: HC $6.00/MF $1.50

Flat samples of 6061-T6 aluminum were impulse loaded with 50 mil x-cut synthetic quartz fliers using a 2.5 inch air gun. An oscillograph record of shock pressure as a function of time was obtained from the rear of the sample using piezoelectric quartz pressure transducers. The fliers were laterally supported and their characteristic low acoustic impedance and high dynamic elastic limit relative to the target material provided square wave pressure loading on the impact surface of the target. The dynamic strain response of the material is calculated from the oscillogram after applying correction for tilt which includes modifications for determining the magnitude of the Baushinger effect during the rare-faction process. The observed specific impulse from the oscillograms agree well with the input specific impulse measured from sabot velocity and peak calculated stress except where peak stresses were lost in sabot tilt. The magnitude of reverse yield

stress in 6061-T6 Al was determined to be 1.3 times the dynamic elastic limit. The overtaking relaxation model proposed by Zubabakin is essentially verified by the unresolvability of peak stresses from sample thicknesses approaching 1 centimeter. This effect accounts for low apparent strain values during rarefaction on some shots. Author (TAB)

N66-35070# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.
INOCULATION OF NODULAR IRON WITH YTTRIUM SILICIDE NODULIZING AGENT Final Report
Wade C. Wurtz Apr. 1966 20 p refs
(RIA-66-1190; AD-635466) CFSTI: HC $1.00/MF $0.50

Although pure metallic yttrium is an effective nodulizing agent for making nodular case iron. It is too costly for use in production. In the present investigation tests were made using a commercially available yttrium silicide, in which the cost of yttrium is much lower than for the pure metal. Laboratory size induction heats of iron were treated with varying amounts of the silicide by introducing it into the metal stream as the molten iron was tapped out into a ladle. After a standard post-inoculation treatment test bar molds were poured. Satisfactory mechanical properties of 55,000 psi yield strength, 72,000 psi tensile strength and 18% elongation were obtained with silicide additions containing yttrium equal to 0.20% of the charge weight. Raising the tap-out temperature improved the tensile and yield strength but lowered the ductility. Nickel additions also increased strength and hardness at the expense of ductility. Yttrium, like magnesium, showed a tendency to fade or slowly lose its nodulizing effect as the iron is held in the molten condition after treatment. Author (TAB)

N66-35080# Arizona State Univ., Tempe. Dept. of Chemistry.
SOLUBILITY AND DIFFUSION OF HYDROGEN IN METALS AND ALLOYS. I: MONOCRYSTALLINE NICKEL–VANADIUM ALLOY
Y. Ebisuzaki, W. Kass, and M. O'keeffe 1 Jun. 1966 15 p refs
(Contract Nonr-2794(04))
(TR-4; AD-635469) CFSTI: HC $1.00/MF $0.50

A method for measuring the solubility and diffusion coefficient of hydrogen in metal single crystals under clean conditions is described. For a nickel −4.4 atom % vanadium alloy the diffusion coefficient is $(7.2\pm0.4)\times10^{-3}\exp(-10.10\pm0.06$ kcal/RT)$cm^2\ sec^{-1}$ and the solubility in atom H per atom of alloy is $(1.12\pm0.05)\times0.0001\exp(-2.09\pm0.05$ kcal/RT). Author (TAB)

N66-35100# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.
LOW CYCLE FATIGUE CRACK PROPAGATION CHARACTERISTICS OF HIGH STRENGTH STEELS
Carl M. Carman and Jesse M. Katlin April 1966 38 p refs
(R-1806; AD-635087) CFSTI: HC $3.00/MF $0.50

The fatigue crack growth properties of various high-strength steels, including the 250 and 300 grades of the 18Ni-Co-Mo maraging steel, H11 steel, and D6A steel, have been studied using a center-cracked specimen. Experiments were conducted by cycling either at a constant stress or at a constant value of the stress intensity parameter, K. Electron microfractographs taken along the path of fatigue crack extension in the 250 grade maraging steel showed the growth ring pattern characteristic of fatigue. Measurement of the growth ring spacings and knowledge of the crack length permit calculation of the rate of crack extension as a function of K. The rates of crack extension, as determined by fractography and actual measurement on the specimen, are in good agreement. A technique for calculating the cyclic life of structure involving a numerical integration of K as a function of crack length and stress was programmed for computer operation. This calculation allows for the change in slope of the K vs da/DN at higher values of cyclic K. The results of these calculations are compared with the life prediction made by simple mathematical integration of the fourth power relationship for an infinite plate. Author (TAB)

N66-35103# Stanford Univ., Calif. Dept. of Materials Science.
THE INFLUENCE OF ALLOYING ELEMENTS ON THE CARBON ACTIVITY IN STEEL Final Report, 1 Jul. 1961–31 Dec. 1965
David A. Stevenson and Richard R. Zupp [1965] 31 p refs
(Grant DA-ARO(D)-31-124-G102)
(AROD-3145-1; AD-635300) CFSTI: HC $2.00/MF $0.50

An experimental method to determine the C activity in various solid solutions was developed. Samples of the solid solutions and an Fe-C reference sample were equilibrated with respect to C content by annealing them in a H_2–CH_4 gas mixture in a closed cell. The C content of each sample was determined, and the C activity was obtained from the C content of the reference sample and well established data for the dependence of C activity on C content in Fe-C alloys. The influence of vanadium on the activity of carbon in austenitic Fe-C-V alloys at 1000°C was determined by this technique. A general semiempirical correlation was developed to describe the dependence of the activity coefficient of C on the composition of ternary austenitic iron-base alloys containing the interstitial carbon and a substitutional solute. The correlation is particularly useful in predicting the partitioning of C between various alloys. Author (TAB)

N66-35147# New York Univ., N. Y. Research Div.
DEVELOPMENT OF COATINGS ADHERENT TO METALS UNDER VIBRATION CONDITIONS Final Report
Max Kronstein 20 May 1966 64 p refs
(Contract NObs-90357)
(AD-634803) CFSTI: HC $3.00/MF $0.75

The factors which influence the life of paint systems on steel under saltwater and ultrasonic vibration were studied. The sonic effects were found to differ in their effect which decreases the adherence of the coating system and their effect which influences the coherence of the coatings with resultant cavitation. A study was made of the form in which the transducer energy is distributed through saltwater. The forms of failure which take place are: loosening of parts of the film from the steel substrate, local pinhole formation, and filament formation. Increased adherence has been found to result from: (a) step-by-step surface preparation, which includes surface inhibition and the driving off of entrapped air in the valleys of the surface profile; (b) the use of primers, including the specification wash-primer-(F 117) and a red lead or zinc chromate vinyl primer so applied that there is inter-reaction between one application and the next; (c) avoiding solvent retention in each application before subsequent coatings are applied; (d) bringing the paint system to a desirable state of cross-linking, or polymer state, without going so far as to lose coherence in the paint film. A description of the pre-treatments used and experimental coating systems developed is given and discussed. TAB

N66-35154# Brown Univ., Providence, R. I. Div. of Engineering.
DETERMINATION OF THE ISOTHERMAL TRANSFORMATION DIAGRAM FOR HIGH CARBON M-2 TOOL STEEL
Jul. 1966 14 p refs
(Contract ARPA SD-86)
(E-32; AD-635478) CFSTI: $1.00/MF $0.50

The isothermal transformation diagram for high carbon M-2 tool steel was determined for material austenitized at 2200° F for 1 hour. The austenitic grain size was identified as ASTM No. 9 and there was 21 volume percent of undissolved carbides at the austenitizing temperature. The diagram was double-nosed with little transformation occurring between 700° and 1150° F. The curve representing the start of precipitation of proeutectoid carbides is included on the isothermal transformation diagram and the M_s temperature was found to be 420° F. Author (TAB)

N66-35163# Library of Congress, Washington, D. C. Aerospace Technology Div.
LIQUID-METAL EMBRITTLEMENT Surveys of Soviet Scientific and Technical Literature
Alex Zurichenko 4 Apr. 1966 29 p refs Annotated Bibliog.
(ATD-66-38)

This annotated bibliography was compiled from Soviet open sources published 1959–1965 with one entry from January 1966. An author index is provided at the end of the report. Pertinent information included: copper alloy testing in mercury salt solution, creep process, diffusion and solubility coefficients of molten metals, polycrystalline metal, tin recrystallization, alloy steel nonselective corrosion, surface tension reduction in solid metals, softening action of agressive melts on solid metal, steel cyclic torsion in low-melting metals, adsorption-induced reduction of strength, irradiation effect on mechanical properties, anisotropy of electron and gamma irradiation effect on deformation process, metal corrosion fatigue, effect of low melting coating on mechanical properties of metals, metal diffusion in liquid copper. Author

N66-35175*# Stanford Univ., Calif. Dept. of Materials Science.
MECHANISMS OF STRENGTHENING AND FRACTURE IN COMPOSITE MATERIALS Progress Report No. 4, Dec. 1, 1965–Jun. 1, 1966
A. S. Tetelman [1966] 12 p refs
(Grant NsG-622)
(NASA-CR-77451) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Theoretical and experimental studies of strength and fracture in various composite materials were conducted. Electron microscope fractography was used to examine the fibrous and cleavage areas of quenched and tempered steels. The strength and fracture behavior of TiC–Mo_2C–Ni composites were determined; and the mechanism of fracture in iron composites of mechanically drilled holes and a B.C.C. metal matrix are discussed. Areas investigated include amount, size of type of particle influence on fracture behavior; sintering treatment influences; and composition influences. L.S.

N66-35177*# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF WELDING TECHNIQUES AND FILLER METALS FOR HIGH STRENGTH ALUMINUM ALLOYS Final Report
H. C. Burghard, Jr. and E. B. Norris 27 May 1966 281 p refs
(Contracts NAS8-1529; NAS8-20160)
(NASA-CR-77511) CFSTI: HC $6.00/MF $1.50 CSCL 11F

Possible means of improving the strength of welded aluminum alloys were investigated, and the mechanical and metallurgical characteristics of these types of weldments were better defined. The program included: (1) development of welding techniques and filler metal alloys, and (2) evaluation of the uniaxial and biaxial mechanical properties of aluminum alloy weldments. Molybdenum inert gas, and tungsten inert gas weldments of various aluminum alloys were studied. It was established that joint preparation methods (machining, cleaning, etc.) exert a strong influence on the soundness of the welds for all material process combinations included in the study. Discussed are results of studies on the aging characteristics, microstructures, yield strengths, crack susceptibility, uniaxial tensile tests, hydraulic bulge tests, cylinder burst tests, and biaxial tests for the various weldments. The detailed report is supported with photographs, data tables, and data curves. L.S.

N66-35242*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
A STUDY OF DEFECT STRUCTURES WITH THE FIELD ION MICROSCOPE First Semiannual Report, 1 Mar.–31 Aug. 1966
J. J. Hren [1966] 33 p refs
(Grant NGR-10-005-039)
(NASA-CR-77478) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The use of a computer model based on the atomic environment of surface atoms is shown to give point for point agreement with experimental field ion micrographs of a high index region in platinum. A detailed description of this model and program along with future extensions of this work are reported. The liquid hydrogen field ion microscope is briefly described. The experimental results on ordered and disordered Ni–Mo alloys are described and briefly discussed. Author

N66-35253# United Kingdom Atomic Energy Authority, Windscale (England). Reactor Develop Lab.
THE STRUCTURE OF 20 Cr–25 Ni–Nb STEEL AFTER AGEING FOR UP TO 2000 HOURS IN THE TEMPERATURE RANGE 600–800°C
R. Sumerling, J. H. Pearce, S. Freeman, and E. Dobing 1966 24 p refs
(TRG-1168(W)) HMSO: 5s

Pieces of unirradiated 20 Cr–25 Ni–Nb stainless steel containing 0.01% and 0.03% carbon, respectively, were aged for 500 and 2000 hr in the range 600–800° C, in a CO_2–CO atmosphere. Structures were examined using electron microscopy of replicas, electron diffraction, and X-ray analysis of extracted residues. Sigma-FeCr was formed during aging as isolated particles at grain boundaries, the degree of sigma formation being greatest for an aging temperature of about 700° C. M_6C-type precipitates formed in all specimens, mainly at grain boundaries, together with intragranular NbC. The Laves phase Fe_2Nb was detected in one low carbon specimen. Specimens aged at 600° and 650° C showed selective etching at grain boundaries, but there was no susceptibility to intergranular corrosion. Electron-probe microanalysis of extracted M_6C precipitates in a specimen aged at 750° C showed that the particles were Ni-rich and also contained some Fe. Author (NSA)

N66-35284# United Kingdom Atomic Energy Authority, Springfields (England). Reactor Group.
SYSTEM C.I.D. (COMPUTERISED INTERPRETATION OF DATA). AN ILLUSTRATION OF THE USE OF A DIGITAL COMPUTER IN THE STORAGE, INTERPRETATION AND RECOVERY OF MATERIALS DATA

L. E. Raraty and J. H. Gittus [1966] 16 p
(TRG-1160(S)) HMSO: 2s 6d

System C.I.D. (Computerised Interpretation of Data) was used to store, interpret, and extrapolate the creep properties of certain magnesium–manganese alloys. An economical, partial factorial experiment involving creep tests at four participating laboratories was used to obtain the creep data. The data were then used to define the thirty-eight constants in a physically reasonable creep equation, by multiple regression analysis in an IBM 7090 computer. The computer was programmed to use the resultant creep equation to answer (by extrapolation if necessary) designers' questions about the likely performance of the alloys in specific applications.

Author (NSA)

N66-35268# Oak Ridge National Lab., Tenn.
ON THE HIGH TEMPERATURE STRENGTH OF 18-8 Mo STAINLESS STEEL CASTINGS
Kanetoshi Iwamoto, Masao Kawabata, Yukishige Fukase, Shoichi Kato, and Nobuhiro Okubo [1966] 11 p refs Transl. into ENGLISH From Zairyo (Japan), v. 14, 1965 p 101–110 Presented at the 7th High-Temp. Symp., 7 Sep. 1964
(ORNL-TR-96)

Type 316 and type 316L stainless steel-castings were subjected to high-temperature tensile tests, creep-rupture tests up to 10,000 hrs at 650°C, aging treatments under various levels of stress at 650°C, and stress-free aging treatment up to 6,400 hrs. at 650° C, and the structural changes during these tests were observed in order to study the relations between the high-temperature properties and the structural changes of both alloys. Carbide and σ-phase were identified by the following means: the techniques of electrolytic etching by using concentrated strong hydroxide solutions (10N, KOH, to color the σ-phase, concentrated NH_4OH, to color the carbide); the X-ray diffraction analysis of the residues obtained by the electrolytic extraction with 10% HCl alcohol solution and $HOC_6H_2(NO_2)_3$ 5% HCl alcohol solution; distribution of Fe, Ni, and Cr in carbide and σ-phase decomposed from δ-ferrite, examined by X-ray microanalyzer; the short and long time high-temperature strength of type 316 is slightly superior to that of type 316L. The superiority of type 316 is attributed to the solid solution hardening effect of carbon and the more uniform distributions of fine carbide and σ-phase in the austenite matrix than in the case of type 316L. But the high-temperature long time load-carrying ability of both alloys seems to be fairly good. There was a little difference observed between type 316 and 316L in their structural changes during the tests, but they take place generally in the following sequences: the δ-ferrite decomposes into ϕ-phase, carbide and σ-phase; the carbide and σ-phase precipitate at austenite grain boundary; carbide and σ-phase precipitate in austenite matrix; decomposition of δ-ferrite and precipitation at austenite grain boundary are accomplished within 1,000 hrs but the precipitatation in austenite matrix gradually proceeds for a long time. Therefore, it is probable that the precipitation of the fine carbide and σ-phase in austenite matrix influences mainly the long time high-temperature strength of these alloys, and that type 316 is a little superior in the high-temperature strength of type 316L, since the precipitates of fine carbide and σ-phase are dispersed uniformly in the austenite matrix of type 316, while the precipitation in the austenite matrix of type 316L is limited only around the regions which were formerly occupied by δ-ferrite. Author (NSA)

N66-35279# Canadian General Electric Co., Ltd., Peterborough (Ontario).
TERMINAL SOLID SOLUBILITY OF HYDROGEN IN ZIRCALOY-2
A. R. Daniel Jun. 1966 16 p refs Reprinted
(AECL-2453; DF-66CAP31) CFSTI: HC $1.00/MF $0.50

Some hundreds of Zircaloy-2 tubular test pieces have been produced with carefully controlled hydrogen contents. The control method used is dependent on the terminal solid solubility of hydrogen in Zircaloy-2. Preliminary experiments did not confirm the published solubility data and it was necessary to construct a terminal solid solubility curve before samples could be produced to consistent hydrogen levels. The test pieces are electrolytically hydrided to a total hydrogen level considerably in excess of that finally required. At this stage the "electrolytic" hydrogen is present as a solid surface layer of hydride several microns in thickness. The final homogeneous hydrogen content is reached by heating the sample at that temperature at which the terminal solid solubility is equal to the desired hydrogen level. The excess hydride, still present as a skin on the surface, is pickled off.

Author

N66-35319*# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
THE EFFECT OF COOLING RATE ON THE DUCTILE-BRITTLE BEND-TRANSITION TEMPERATURE OF CHROMIUM WIRE
A. Gilbert and M. J. Klein Nov. 1965 9 p refs Submitted for Publication
(Contracts NASw-101; W-7405-ENG-92)
(NASA-CR-68115) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The effect of cooling rate on the ductile-brittle bend-transition temperature of chromium wire was studied to determine the effects of interstitials on the mechanical properties of quenched and slow-cooled material. Presented are results of comparative studies on chromium quenched at a very high rate using internal friction as an indicator of the amount of nitrogen in solution. Quenched material was found to be more brittle than furnace-cooled material. Bend test results for quenched and for quenched and aged chromium wire indicated that the transition from ductile to brittle behavior was extremely sharp in that a specimen either failed in a completely brittle manner or bent to the maximum extent permitted by experimental conditions. Nitrogen analyses showed that all the nitrogen present in the material was in solid solution as a result of the quench, and that after aging for times greater than 3000 minutes, nitrogen was largely present as a precipitated phase in accordance with the predictions of equilibrium-solubility data. It is concluded that nitrogen completely in solution is less detrimental to ductility than nitrogen combined in a second phase. S.C.W.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-34086# General Electric Co., Cincinnati, Ohio. Atomic Products Div.
RADIATION EFFECTS IN BeO
In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 221–262 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Irradiation behavior of beryllium oxide was defined in terms of the composition and microstructure variables that contribute to extended radiation stability. Defect clusters formed during elevated-temperature irradiation were identified as interstitial in

nature and appeared to be paired Be and O layers; and this identification led to revisions in the kinetic equations for describing the expansion in BeO due to lattice defects, such as the expansion exclusive of microcrack voids and helium bubbles. Helium bubble measurements indicated the possibility of continued expansion of the material after saturation due to lattice effects. Such expansion is expected to limit the dosage to BeO. These helium bubbles in the grain boundaries accounted for about 1.1% of the 1.7% expansion in BeO specimens irradiated at 1000°C to a dosage of 2.5×10^{21}nvt. Helium retained in BeO in elevated-temperature irradiations ranges from 60 to 90%, with the majority retained in the grains. M.W.R.

N66-34099# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

FISSION GAS DIFFUSION IN UNFUELED CERAMIC MATERIALS

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 279–281 refs (See N66-34084 20-22) CFSTI: HC $6.00/MF $1.50

Diffusion of krypton, xenon, and iodine atoms in ceramic oxides of aluminum, beryllium, magnesium, and zirconium was studied following injection via ion bombardment. The experimental procedure consisted of target preparation, injection of 35-keV krypton ions into the targets, and measurement of the amount of krypton diffusant remaining in the target as a function of time at constant temperature. The targets were single-crystal sapphire and polycrystalline BeO disks. Krypton release at 1100 and 1200°C in Al_2O_3 suggests that the crystal lattice orientation during injection influences the magnitude of the initial burst from the ion-bombarded material, although a temperature-dependent release is not apparent. Krypton release from BeO does indicate temperature dependency, however. Additional research on this program was stopped when direct observations made by transmission electron microscopy showed rather conclusively that the transport of the injected atoms in a ceramic sample proceeded via the migration of small gas bubbles in addition to atom diffusion transport. M.W.R.

N66-34131*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

CRYOGENIC ADHESIVE APPLICATION

Richard L. Long *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 102 p refs *Its* Paper No. 3899 (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

Thermosetting and catalyzed adhesives are used extensively on the Saturn S-IV and S-IVB stages in elevated and cryogenic environments. The history of the selection of the adhesives and the evolution from the original choices to the materials currently used for cryogenic environments are discussed in this paper. Only the low temperature cure bonding materials are carried forward, and the general presentation concentrates on polyurethane adhesives. The discussion on polyurethane adhesives includes a limited evaluation of the advantages and disadvantages of this material both with respect to properties and the processes of application. Special tests and more useable methods of data presentation have evolved as a by-product of the development of the polyurethane adhesives and new applications are possible. Recommendations are made to obtain a more versatile low temperature curing cryogenic adhesive, and suggestions are made on the economical application of new research and development techniques to obtain this new material. Author

N66-34132*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

STATUS OF ADHESIVES RESEARCH AT MARSHALL SPACE FLIGHT CENTER

W. Hill *In its* Structural Adhesive Bonding Conf. 14 Mar. 1966 15 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

Poly-2-oxazolidones, polyisocyanurates, polyurethanes, bisphenol epoxies, and epoxy esters were examined in a synthetic program for developing a cryogenic adhesive with an expanded temperature range of utility. Accelerated aging of polyurethane bonded lapshear specimens in tests conducted to date have indicated bond deterioration even for primed specimens, although primed bondlines maintained higher strengths throughout. A primer screening study revealed certain silane derivatives to be good primers for aluminum adherends bonded with polyurethane adhesive systems. A relationship between time of cure at a given temperature and Bell peel strengths at two test temperatures was used to derive an expression for time required for minimal cure of a polyurethane adhesive system at a given temperature. Preparation of fluorinated monomers for fluorinated polymer systems was recently initiated. Author

N66-34133*# Picatinny Arsenal, Dover, N. J.

THE FUNCTION OF THE PLASTICS TECHNICAL EVALUATION CENTER (PLASTEC)

Harry E. Pebly, Jr. *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 18 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

PLASTEC is one of 22 specialized information analysis centers monitored by the Department of Defense. It provides a centralized source of information on properties and applications of plastics in defense, on project and contract activity, and on personnel active in the field. Its output is two-fold: answers to inquiries and reports written by its staff on timely areas of materials, technology, processing and applications. Services are available to government agencies, their contractors and suppliers, libraries, and universities. Information on plastics is also available by subscription to the Plastics Section of Engineering Index and through various services of the Commerce Department's Clearinghouse for Federal Scientific and Technical Information. Author

N66-34194# Office of Naval Intelligence, Washington, D. C. Translation Section.

TECHNOLOGY OF MANUFACTURE AND PROPERTIES OF ANTIFRICTION MATERIALS CONTAINING FLUOROPLASTICS: BASIC PRINCIPLES OF PRODUCTION

A. P. Semenov, P. M. Matveyevskii, and V. V. Pozdnyakov [1966] 61 p ref Transl. into ENGLISH of the Book "Tekhnologiya Izgotovleniya i Svoystva Soderyashchikh Ftoroplast Antifriktsionnykh Materialov (Osnovnyye Printsypy Proizvodstva" Moscow, Izd. Akad. Nauk SSSR, 1963 (ONI-TRANS-2141; TT-66-61504; AD-634308) CFSTI: HC $3.00/MF $0.75

Contents: Comparative friction tests of various polymers with and without lubrication; Certain information on the physical, mechanical and technological properties of fluoroplastic-4 (polytetrafluoro ethylene); Possible means of utilizing the properties of fluoroplastic-4 developing antifriction materials and coatings; Survey of existing information on the use of fluoroplastic-4 in antifriction materials; Possible industrial procedures for manufacturing combines of antifriction materials containing fluoroplastic; Technological process of the manufacture of steel-porous bronze tape material impregnated with fluoroplastic; Comparison tests of various materials containing fluoroplastic; Conditions and possible fields of application of antifriction tape material containing polytetrafluoro ethylene. Author

N66-34270# Honeywell, Inc., Hopkins, Minn. Corporate Research Center.

DEFORMATION AND FRACTURE OF IONIC SOLIDS Final Report

Robert J. Stokes May 1966 80 p refs
(Contract Nonr-4076(00))
(HR-66-262; AD-634733) CFSTI: HC $3.00/MF $0.75

This summarizes the nature of point, line and surface defects in ceramics. The interactions between these defects and their role in the various modes of mechanical deformation are then reviewed. The paper examines anelastic effects, plastic yielding, brittle and ductile fracture, and creep in single crystal and polycrystalline ceramics. Emphasis is on the behavior of ideal, well characterized materials of high purity and zero porosity with the intent of presenting the fundamental background to the subject. Author (TAB)

N66-34294# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POSSIBILITY OF THE INVESTIGATION OF THE KINETICS OF OIL SOLIDIFICATION BY THE ULTRASONIC METHOD
V. F. Dudin, ZH. I. Shaulov, and S. N. Khadzhiyev 21 Jan 1966 12 p refs Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (Moscow), no. 8, 1964 p 58-60
(FTD-TT-65-1484; TT-66-61415; AD-633714) CFSTI: HC $1.00/MF $0.50

The amplitude of ultrasonic impulses passing through a 10-mm-thick oil layer was measured with an impulse meter with piezo-pickups. Amplitudes of the impulses were held at unchanging levels and were led to oscillographs. Absorption was judged by impulse strength. The oil samples were heated to 55°C and then cooled to room temperature. The impulse amplitude changed only when the temperature was attained at which the ultrasonic effect on solid hydrocarbon becomes ineffective. The impulse amplitude dependence on temperature was identical for all samples. De-paraffined and black oil samples and their mixtures were used in the tests. Increased absorption of ultrasonic impulses is attributed to a decrease in solubility of solid hydrocarbons at lowered temperatures and the resulting formation of a solid phase. The ultrasonic method was found to be preciser than visual observation in reading the temperature of turbidity, and it is pointed out that it should be used along with other methods in analyzing structured systems. K.W.

N66-34299# Union Carbide Corp., Bound Brook, N. J. Plastics Div.
COMPOSITE THERMOPLASTIC/GLASS FILAMENT REINFORCEMENT FOR BUOYANT SUBMARINE CABLE Interim Development Report, Mar. 10-Jun. 10, 1966
[1966] 10 p
(Contract NOO-140-66-C-0403)
(AD-634719) CFSTI: HC $1.00/MF $0.50

The report describes the accomplishments for the development of two thermoplastic/glass reinforced electrical transmission lines. Covering the assembling of the equipment for impregnation of glass roving, and the evaluation of various glass - thermoplastic filaments, the experimental data to date show that: 1. both E and S glass will give a theoretical strength, above the required 1200 lbs. for the insulated wire, (1800 and 2500 lbs. respectively). 2. increasing coating percentage increases tensile strength, and abrasion resistance. 3. S glass will be used as a screening media. E glass is much less expensive and more readily available. Author (TAB)

N66-34301# Linden Labs., Inc., State College, Pa.
CHEMICAL STRENGTHENING OF CERAMIC MATERIALS Summary Report, 7 Apr. 1965-6 Apr. 1966
Henry P. Kirchner, Robert M. Gruver, and Ralph E. Walker 7 May 1966 139 p refs
(Contract NOw-65-0407-c)
(AD-634381) CFSTI: HC $4.00/MF $1.00

An investigation of the effect of compressive surface layers on the strength of polycrystalline ceramic bodies is described. Low expansion surface layers were formed on polycrystalline ceramics by chemical reactions at high temperatures. During cooling after sintering, the main body tends to contract more than the surface layers leading to compressive stresses in the surfaces. Failure, by shearing of the surface layers, was prevented by establishing gradual variations in composition within the body. These variations in composition result in variations in expansion coefficient which, in turn, result in gradual variations in stresses and reduction of the maximum shear stress in the surface layer. The compressive stresses may act to reduce the contribution of surface flaws to the structural failure of these bodies. Chemical strengthening was attempted with alumina, titania, spinel, magnesia, forsterite, steatite, nickel oxide and zirconia bodies and was achieved for the first six materials named. The experiments with nickel oxide and zirconia gave unreliable results. Author (TAB)

N66-34588# Naval Ordnance Lab., White Oak, Md. Chemistry Research Dept.
THE COMPRESSIBILITY OF POLYMERS TO 20,000 ATMOSPHERES Interim Report
Robert W. Warfield 1 Jun. 1966 35 p refs
(NOLTR-66-45; AD-635121) CFSTI: HC $2.00/MF $0.50

Bulk compressibilities of a series of linear and crosslinked polymers have been measured at pressures up to 20,000 atmospheres and over the temperature-range 22°C to 200°C. These polymers exhibited nonlinear compressibility characteristics reaching a maximum magnitude of the compressibility of about 20% at 20,000 atmospheres. In this report the nature of the observed compressibilities are discussed and glass-rubber phase diagrams are given for several systems. It is shown that the compressibility of polystyrene is time dependent. Author (TAB)

N66-34670*# Harris Research Labs., Inc., Washington, D. C.
THE REINFORCEMENT OF POLYMERIC STRUCTURES BY ASBESTOS FIBRILS Final Report, 1 Apr. 1965-30 Apr. 1966
A. M. Schwartz, C. A. Rader, and A. E. Davis [1966] 36 p
(Contract NASw-1183)
(NASA-CR-77225) CFSTI: HC $2.00/MF $0.50 CSCL 11I

To determine the structural potential of asbestos fibrils for reinforcing polymeric matrixes, ultimate asbestos fibrils (UAF) of 250 Å to 500 Å diameter were used due to their expected strength advantages over conventional macroscopic asbestos fibers (MF). Techniques were developed for dispersing conventional asbestos fibers into extremely fine UAF, incorporating the UAF in polymeric matrixes, and forming sheet-form composites suitable for tensile testing. Details are also given on methods by which the dispersion to UAF is carried out directly in organic solvents for the matrix resins, or in liquid, monomeric, resin precursors. Composites were also prepared from aqueous dispersions of UAF in which water soluble resin precursors were employed as the dispersants. The strength properties of UAF-reinforced composites were found to be influenced by such variables as the reinforcing fibril length, the presence of conditioner or coupling agent, and the nature of the polymer matrix. Results indicate that the UAF have a reinforcing effect in a variety of polymeric matrixes. M.G.J.

N66-34686*# Stanford Research Inst. Menlo Park, Calif.
STUDY OF BONDING BETWEEN GLASS AND PLASTIC IN GLASS-REINFORCED PLASTIC—EXTENDED WORK Quarterly Progress Report No. VII, 1 Apr.-30 Jun. 1966
David L. Chamberlain, Jr. 31 Jul. 1966 7 p refs *Its* Rept.-9
(Contract NASr-49(14))
(NASA-CR-77384) CFSTI: HC $1.00/MF $0.50 CSCL 11J

Systems for evaluating the effects of surface modification upon a composite material are described. Dilatometric studies were continued as a screening procedure for the effect of surface modification of silica or glass. It was found that undecyl groups are more effective than butyl groups in reducing the surface free energy of the silica. Alkoxylation of silica surfaces, dodecene oxide reactions with cleaned low-iron silica, and treatment of high-surface silica with ethylenimine are discussed. N.E.N.

N66-34692# Royal Aircraft Establishment, Farnborough (England).
THE RATIO OF THE GLASS TEMPERATURE TO THE MELTING POINT IN POLYMERS
W. A. Lee and G. J. Knight Jan. 1966 44 p refs
(RAE-TR-66005) CFSTI: HC $2.00/MF $0.50

The ratio is found to vary widely between 0.5 and 0.8, and 20% of polymers have ratios outside this range. There is no basis for distinguishing between symmetrical and unsymmetrical polymers or between their crystalline forms. It is suggested that this result is not wholly unexpected. Author

N66-34717# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
THE STRENGTH AND DEFORMATION PROPERTIES OF SINTERED ALUMINA BODIES AS A FUNCTION OF THEIR COMPOSITION AND STRUCTURE
W. Dawihl and E. Doerre Mar. 1965 43 p refs in GERMAN and ENGLISH transl. into ENGLISH from Ber. Deut. Keram. Ges. (Bonn), v. 41, no. 2, 1964 p 85–96 Presented at the Deut. Keram. Ges. Conf., Wiesbaden, 13 Sep. 1963
(NP-TR-1234) CFSTI: HC $4.60/MF $1.49

An investigation was conducted to find out if any diffusion processes are detectable in pure alumina at temperatures below 1200° C. The starting materials were powders and the method employed was to measure the specific surface and to determine, by X-ray, lattice stresses and their release after different heat treatments. Sintered bodies were investigated at room temperature, at 500 and 1000° C for their crushing strength, impact bending strength, shrinkage, and hardness in two series of experiments: first varying the MgO and SiO_2 content and keeping the firing conditions constant and second varying the firing conditions and keeping the composition constant. It was found that there is a definite relationship between the measured temperature-dependent properties, on the one hand, and composition, structure, and porosity, on the other. The experiments were extended to include electron-microscope observations of alumina surfaces that had been suitably prepared by heat treatment and etching. Comparison between sintered bodies of tungsten carbide with small additions of cobalt and sintered alumina bodies with small additions of MgO reveals many similarities. Author (NSA)

N66-34762# Denver Research Inst., Colo.
DETERMINATION OF PHASE EQUILIBRIA IN THE SYSTEM BeO-ThO_2 Final Report
Henry E. Otto 30 Sep. 1965 18 p refs
(Contract AT(11-1)-1092)
(DRI-1092-219; DRI-2482) CFSTI: HC $1.00/MF $0.50

A study of the BeO-ThO_2 system has shown that a eutectic occurs at 70 mole % BeO (18.1 wt %) and 2155° C ± 5°. The solid solubility of ThO_2 in BeO below the eutectic temperature is less than 0.016 mole % ThO_2 (0.16 wt %), and the solid solubility of BeO in ThO_2 is less than 0.1 mole % BeO (0.0095 wt %). Small amounts of ThO_2 have no effect on the β to α BeO phase inversion. Author (NSA)

N66-34859*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MECHANICAL AND PHYSICAL PROPERTIES OF THE ECHO II METAL-POLYMER LAMINATE
C. L. Staugaitis and L. Kobren Washington, NASA, Aug. 1966 36 p refs
(NASA-TN-D-3409) CFSTI: HC $2.00/MF $0.50 CSCL 11D

Results of a comprehensive investigation of the physical and mechanical properties of the Echo II material are reported. The Echo II material (an aluminum–mylar–aluminum composite film) was subjected to a variety of tests and environmental controls designed to evaluate its properties under anticipated service conditions. This test program included the determination of creep and relaxation properties, peel strength, electrical conductivity, and uniaxial and biaxial stress properties. Additional tests were performed on material which had been exposed to electron radiation of various energies and total exposures. In addition to laboratory tests on small samples of the composite film, biaxial strain data were obtained from a full size balloon used in a Static Inflation Test. Test results including a failure analysis performed on several full scale balloons which failed prematurely are also reported. Author

N66-34935*# TRW Systems, Redondo Beach, Calif.
INVESTIGATION OF RESIN FOR IMPROVED ABLATIVE MATERIALS Final Report, 19 Jun. 1964–31 Jul. 1965
H. R. Lubowitz, E. A. Burns, and B. Dubrow 1 Apr. 1966 219 p refs
(Contract NAS3-4188)
(NASA-CR-54471; TRW-4176-6014-50-000) CFSTI: HC $3.75/MF $1.25 CSCL 11I

Work performed to advance the state-of-the-art of resin matrices required for improved ablative materials for use with high energy fluorine-containing liquid propellant systems is described. Critical resin properties which influence the effectiveness of ablative composites were determined analytically in order that criteria could be established for the synthesis and property testing of new and modified resins. Several new polymer systems with improved properties were proposed, evaluated and recommended for future study. Poly (cyclized 1, 2-polybutadiene) tolyl urethane ladder polymers, poly alkaline earth metal acrylates, phosphate bonded oxides, modified polyimides and several other organic and inorganic systems were conceived and/or evaluated during this program to meet the property requirements identified analytically. Author

N66-35059# Picatinny Arsenal, Dover, N. J. Plastics and Packaging Lab.
SYNTHESIS OF NOVOLAC EPOXY RESINS
Erwin A. Hoess and William C. Tanner Jul. 1966 25 p refs
(PA-TR-3293; AD-634982) CFSTI: HC $1.00/MF $0.50

Novolac resins were prepared from p-chlorophenol using a variety of sources for methylene bridges. Alkaline and acidic catalysts were used to promote condensations; however, the products obtained were not always true novolacs in that polyhydroxybenzyl ethers and polyhydroxybenzylamines were isolated. Molecular weights varied from that of the "dimer" to 1500 for the true novolacs and as high as 1975 for the polyhydroxybenzyl ethers. Dechlorination of the various resin species was successful. Polyglycidyl ethers (epoxy resins) were formed from several species of the resins. Author (TAB)

N66-35172*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS Triannual Report, Jan. 21–Jun. 20, 1966

Gene A. Zerlaut 11 Jul. 1966 41 p
(Contract NAS8-5379; 933-50-01-0000; 124-09-05-0014; 908-20-02-0147)
(NASA-CR-77438; IITRI-U6002-42) CFSTI: HC $2.00/MF $0.50 CSCL 11C

The objective of the research reported herein is the development of thermal-control surface coatings which possess very low but stable ratios of solar absorptance to infrared emittance. The work reported consists of (1) completion of the heat-treatment studies of the double zirconium silicate pigments, (2) an investigation of the effect of heat treatment on potassium silicate-treated zinc oxide and silicone paints prepared therefrom, and (3) additional space simulation test involving *in situ* reflectance measurement capabilities. Of the three double zirconium silicate pigments (i.e., calcium, magnesium and zinc), calcium zirconium silicate exhibits the best stability. In general, heat treatment of the double silicate paints after application increases stability whereas heat treatment of the pigment prior to incorporation in the vehicle decreases stability. Author

N66-35207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION CHARACTERISTICS OF SINGLE CRYSTAL AND POLYCRYSTALLINE ALUMINUM OXIDE IN CONTACT IN VACUUM
Donald H. Buckley Washington, NASA, Sep. 1966 15 p refs
(NASA-TN-D-3599) CFSTI: HC $1.00/MF $0.50 CSCL 11B

An investigation was conducted in vacuum to gain a better understanding of the friction and adhesion concepts of the ceramic material aluminum oxide in its single-crystal (sapphire) and polycrystalline forms in sliding contact with aluminum oxide of the same crystallinity. Experiments were conducted in a vacuum to 10^{-10} millimeter of mercury with surfaces which were outgassed. The specimens were a hemispherical or spherical surface sliding on a rotating flat surface. The materials were studied at rotating speeds of 0.013 centimeter per second, loads to 1500 grams, and ambient temperatures to 575° C. The results of the investigation have shown that the friction characteristics for sapphire sliding on sapphire are highly anistropic and are determined by plastic deformation of the sapphire. With the pollycrystalline material, friction coefficients obtained were intermediate between the values obtained for the prismatically and basally oriented single-crystal material. Author

N66-35317*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry
SEEDING OF SUPERCOOLED POLYETHYLENE WITH EXTENDED CHAIN CRYSTALS
Bernhard Wunderlich and C. M. Cormier [1965] 24 p refs Submitted for publication
(Grant NsG-100)
(NASA-CR-68621) CFSTI: HC $1.00/MF $0.50 CSCL 11I

Seeding of supercooled polyethylene melt and solution with extended chain single crystals did not markedly decrease the degree of supercooling necessary to initiate crystal growth. No extended chain growth was induced with these nuclei. An analysis of the first traces of crystal growth allowed some conclusion about nucleation and growth mechanism. In order to account for the here presented measurement a growing crystal must have a 10,000 to 30,000 Å thick surface layer which increases in perfection from the outside to the inside. A differential scanning calorimeter was used for most of the experiments. Author

N66-35344# TEEG Research, Inc., Detroit, Mich.
INVESTIGATION OF ULTRA HIGH STRENGTH BULK GLASS
Final Technical Report, Mar. 1965–Mar. 1966
Robert O. Teeg, Gordon L. Zucker, and Robert W. Hallman 15 Apr. 1966 82 p refs
(Contract NOw-65-0388-Ff)
(TR-900-008; AD-635029)

A technique is described by which the intrinsic strength of bulk glass can be measured. The technique is applied to examine the factors which influence the engineering strength of glass. Results of tensile strength measurements on bulk borosilicate glasses, obtained by bending tests, approach theoretical values. Measurement of the temperature dependence of strength in the range of 350° to 600 °C reveals an interesting strength–temperature transformation. Electrical measurements are also performed in this temperature range in an effort to interrelate electrical and mechanical behavior. Sulfide glass preparation and evaluation techniques are described to provide test specimen composites capable of exhibiting intrinsic strength near room temperature. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-34104# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
A MULTIVARIATE EXPONENTIAL DISTRIBUTION
Albert W. Marshall and Ingram Olkin (Stanford Univ.) Mar. 1966 38 p refs */ts* Math. Note. No. 450
(Grant NSF GP-3837)
(D1-82-0505; AD-634335) CFSTI: HC $2.00/MF $0.50

A number of multivariate exponential distributions are known, but they have not been obtained by methods that shed light on their applicability. This paper presents some meaningful derivations of a multivariate exponential distribution that serve to indicate conditions under which the distribution is appropriate. Two of these derivations are based on shock models, and one is based on the requirement that residual life is independent of age. It is significant that the derivations all lead to the same distribution. For this distribution, the moment generating function is obtained. Comparison is made with the case of independence. The distribution of the minimum is discussed, and various other properties are investigated. A multivariate gamma distribution is obtained by convolution, and a multivariate Weibull distribution is obtained and through a change of variables. Author (TAB)

N66-34163# Texas Univ., Austin. Computation Center.
A STUDY OF OPERATORS IN APPROXIMATION THEORY
Interim Technical Report No. 9
Yasuhito Ikebe Apr. 1966 133 p refs
(Grants DA-ARO(D)-31-124-G721; NSF GP-5253)
(AROD-3772-23; AD-633692) CFSTI: HC $4.00/MF $1.00

This dissertation consists of two independent chapters. The first chapter studies constants associated with best-approximation maps mainly in the space of all real-valued continuous functions on a closed interval. The second chapter contains several generalizations of a theorem due to Cheney and Goldstein. This theorem establishes the existence of bounded linear operators which best approximate nonlinear operators under certain conditions. The well known Alaoglu theorem is also obtained in this chapter as a special case of more general theorems. Author (TAB)

N66-34224# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
ANALYTIC REPRESENTATION OF GENERALIZED FUNCTIONS

John J. Benedetto May 1966 34 p refs
(Contract Nonr-595(17))
(BN-450; AD-634559) CFSTI: HC $2.00/MF $0.50

An analytic function is associated with a given distribution, and a means of retrieving the original distribution in terms of limits of differential operations on the function is developed. The classical Stieltjes kernel is used to map the distribution space into the space of analytic functions. Further topics for Stieltjes transforms are also discussed. N.E.N.

N66-34240# RAND Corp., Santa Monica, Calif.
PARITY PATTERNS ON EVEN SEMIGRAPHS
Norman C. Dalkey May 1966 5 p ref Submitted for Publication
(P-3376; AD-634755) CFSTI: HC $1.00/MF $0.50

A combinatorial analysis is used for parity patterns in even semigraphs. A semigraph is defined as an elementary cycle in the plane, completely triangulated on one side, with no points or lines on the other side; if all points not points of the cycle are of even degree, the semigraph is called even. Proof is given for odd, and even cases of a theorem that for even semigraph G, with bounding cycle C and parity-pattern P(C), there exists an even semigraph G' with bounding cycle C' of the same length as C with P(C)=P(C') and G' contains at most one point not in C'. R.L.I.

N66-34255# Air Force Cambridge Research Labs., Bedford, Mass.
CATEGORIZATIONS AND REALIZATIONS OF POSITIVE REAL AND BIQUADRATIC IMMITTANCE FUNCTIONS
Kurt H. Haase Apr. 1966 92 p refs *Its* Phys. and Math. Sci. Res. Papers No. 215
(AFCRL-66-243; AD-634764) CFSTI: HC $3.00/MF $0.75

It is shown that a positive real immittance function F(s) is of one of eight categories. The category can be recognized by the sign polarities of three test values that are functions of the coefficients of F(s). If F(s) is of a certain category, then 1/F(s) can only be of some other categories. According to the categories of F(s) and 1/F(s) the immitance function can be realized (1) either by an RC or an RL network with positive elements, (2) by an RLC network with exclusively positive elements and an equivalent model circuit, or (3) only by model circuits. A model circuit is an RLC ladder structure with one negative branch element. The RC, RL, RLC, and model circuits have several equivalences.
Author (TAB)

N66-34280# RAND Corp., Santa Monica, Calif.
CONTRACTION MAPPINGS IN THE THEORY UNDERLYING DYNAMIC PROGRAMMING
Eric V. Denardo Jun. 1966 36 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4755-1-PR; AD-634348) CFSTI: HC $2.00/MF $0.50

A formulation and analysis of a broad class of optimization problems including many, but not all, dynamic programming problems. The formulation generalizes those of several authors and provides further insight into the class of problems which satisfy Bellman's principle of optimality. Three widely shared properties of optimization problems are abstracted; they are called contraction, monotonicity, and N-stage contraction properties. Analysis is conducted of those classes of problems satisfying the first property, the first two properties, and the last two properties. In each case, a fixed-point argument guarantees that a functional equation has a unique solution; in the latter two cases that solution is the optimal return function. Policies whose return functions attain or approximate the fixed point are shown to exist, and three techniques for determining such policies are presented. The techniques are successive approximations, mathematical programming, and a generalization of one of Howard's policy improvement routines. Certain issues concerning history-remembering decision procedures and stationary processes are settled. Examples are provided, and apparent integrability issues in some of them are circumvented. Author (TAB)

N66-34345# Stanford Univ., Calif. Dept. of Computer Science.
MINIMUM MULTIPLICATION FOURIER ANALYSIS
R.W. Hockney 14 Dec. 1965 56 p refs
(Contract Nonr-225(24))
(CS32; AD-633557) CFSTI: HC $3.00/MF $0.50

Fourier analysis and synthesis is a frequently used tool in applied mathematics but is found to be a time consuming process to apply on a digital computer and this fact may prevent the practical application of the technique. This paper describes an algorithm which uses the symmetries of the sine and cosine functions to reduce the number of arithmetic operations by a factor between 10 and 30. The algorithm is applicable to a finite Fourier (or harmonic) analysis on 12×2^q values where q is any integer >0 and is applicable to a variety of end conditions. A complete and tested B5000 Algol program known as Fourier 12 is included. Author (TAB)

N66-34356# Joint Publications Research Service, Washington, D. C.
SEVERAL PROPERTIES OF AN OPTIMAL TWO-STEP PROCEDURE FOR DIFFERENTIATION BETWEEN STATISTICAL HYPOTHESES
Yu. B. Sindler *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 11-17 refs (See N66-34353 20-10) CFSTI: $3.00

The properties of an optimum two-step procedure are determined for differentiating between two statistical hypotheses. To demonstrate the properties an example of sampling quality control of products is considered. Characteristics of the control procedure are discussed, and the development of solution probabilities is shown. Problem solving by the method of Lagrange multipliers is demonstrated, and a diagram of various functions characterizing the mathematical relationships is presented. A.G.O.

N66-34358# Joint Publications Research Service, Washington, D. C.
GENERALIZED PREDICATES AND DECISION MAKING
B. M. Fitingof *In its* 22nd All-Union Sci. Session Devoted to Radio Day: Cybernetics Sect. 1 Aug. 1966 p 24-27 (See N66-34353 20-10) CFSTI: $3.00

The problem of decision making is considered in a general intermediate case for arbitrary probability predicates on the states of nature which may be obtained from practical experience. It is shown that such predicates are represented by convex polyhedrons of arbitrary form, and that probability predicates which usually occur in known mathematical theories are reduced to a narrow class representing only a specific type of simplexes. The report also shows that the results of the effects of disjunction and conjunction distributions correspond to the formation of combinations, hulls, or intersections of polyhedrons representing the original predicates. A.G.O.

N66-34473# Wisconsin Univ., Madison. Dept. of Statistics.
THE USE OF PRIOR DISTRIBUTIONS IN THE DESIGN OF EXPERIMENTS FOR PARAMETER ESTIMATION IN NONLINEAR SITUATIONS

Norman R. Draper and William G. Hunter Apr. 1966 17 p refs
(Contract Nonr-1202(17); Grant NSF GP-2755)
(TR-68; AD-634770) CFSTI: HC $1.00/MF $0.50

Examined, for a single known response case, is the manner in which prior information on the parameters in the form of a multivariate normal distribution can be used in selecting designs for parameter estimation. The distribution function in the design of experiments is discussed and a Bayesian theorem is used in formulation. It is assumed that prior information available before the N runs were performed could be expressed by the multinormal distribution. Maximizing the posterior distribution was chosen as a criterion, and a practical procedure for choice of experimental runs using the simplified criterion is given. An example is presented to illustrate how the precision of the prior noowledge can affect the positioning of the design points. R.L.L.

N66-34474# Illinois Univ., Urbana. Coordinated Science Lab.
QUADRATIC DIFFERENTIAL SYSTEMS FOR MATHEMATICAL MODELS
Richard D. Jenks May 1966 139 p refs
(Contract DA-28-043-AMC-00073(E))
(R-290; AD-633861) CFSTI: HC $4.00/MF $1.00

This study is concerned with a set of n coupled non-linear differential equations. Such systems suggest mathematical models in almost every branch of the physical sciences where collisions of entities are involved. This paper is essentially in three parts. The first part concerns general n-dimensional systems, and stability of critical points of the above system are given. Certain connectedness concepts are introduced for classification purposes. The second part deals with lower dimensional systems, n=2 and n=3. For n=3, a geometric theory of completely positive systems uncovers a large class of systems which have unique critical points in the interior of the first orthant and which are asymptotically stable in the large. The third part considers a mathematical model for the collision of molecules in a uniform gas. The classical Boltzmann model is discretized by considering the velocity space to be partitioned into a finite number of mutually exclusive regions called bins, each with its own distribution function. This assumption not only greatly simplifies the Boltzmann integro-differential equation but also suggests quadrature methods for numerical evaluation of the Boltzmann integral. Author (TAB)

N66-34525# Wisconsin Univ., Madison. Dept. of Statistics.
RESPONSE SURFACE DESIGNS FOR FACTORS AT TWO AND FOUR LEVELS
Normal R. Draper and David M. Stoneman May 1966 16 p refs
(Contract Nonr-1202(17))
(TR-73; AD-634773) CFSTI: HC $1.00/MF $0.50

In a previous paper, AD-634 771, the authors considered the construction of response surface designs for situations where P factors could be examined at two levels and Q factors could be examined at three levels. These designs consisted of portions of the corresponding 2(P)3(Q) factorial designs. In this paper they extend the construction method to situations where P factors are at two, and Q factors are at four levels. Author (TAB)

N66-34533# Wisconsin Univ., Madison. Dept. of Statistics.
RESPONSE SURFACE DESIGNS FOR FACTORS AT TWO AND THREE LEVELS
Norman R. Draper and David M. Stoneman May 1966 35 p refs
(Contract Nonr-1202)
(TR-70; AD-634771) CFSTI: HC $2.00/MF $0.50

The choice of an experimental design suitable for fitting a graduating polynomial can be made according to a number of criteria, depending on the problem involved. Difficulties arise when, although the factors are continuous in nature, the number of levels is specified by some external considerations. For example, if some factors can be examined at only two levels, the graduating function cannot include quadratic terms in those variables, but all second order terms for variables to be examined at three or more levels can be permitted. For such cases, a restricted model and special experimental designs are needed. This paper considers the problem when there are some factors at two levels and some factors at three levels. Author (TAB)

N66-34537# Washington Univ., Seattle. Dept. of Mathematics.
CONJUGACY CLASSES IN LIE ALGEBRAS AND ALGEBRAIC GROUPS
R. W. Richardson, Jr. Jun. 1966 22 p refs
(Contract Nonr-477(15))
(TR-29; AD-634734) CFSTI: HC $1.00/MF $0.50

Kostant has shown that a complex semi-simple Lie algebra has only a finite number of nilpotent conjugacy classes. This paper shows how Kostant's theorem can be obtained as a special case of an elementary theorem on conjugacy classes in reductive subgroups of algebraic subgroups. As a corollary of this theorem we show that a semi-simple algebraic group over an algebraically closed field of characteristic p>5 has only a finite number of unipotent conjugacy classes. Related conjugacy theorems are proved for subalgebras and homomorphisms of Lie algebras. Author (TAB)

N66-34545# Wisconsin Univ., Madison. Dept. of Statistics.
QUANTIFICATION OF OCKHAM'S RAZOR BY VIOLATION OF THE LIKELIHOOD PRINCIPLE
Mervyn Stone Mar. 1966 15 p refs
(Contract Nonr-1202(17))
(TR-66; AD-634768) CFSTI: HC $1.00/MF $0.50

For inference situations with an ancillary statistic, a quantifier, based on a significance level whose calculation involves the distribution of the ancillary statistic, is described which provides a quantification of Ockham's Razor. Its application is proposed for those cases where the method of maximum likelihood fails, due to overparametrization, or rather, inadequate experimentation. Examples described include (1) A curve fitting problem (2) A problem involving the observable convolution of two individually unobservable binomial variables. Author (TAB)

N66-34609# Naval Avionics Facility, Indianapolis, Ind.
MINIMUM SIZE SAMPLING PLANS FOR SMALL LOTS FOR A GIVEN LOT TOLERANCE PERCENT DEFECTIVE (LTPD) AND PROBABILITY OF ACCEPTANCE
Cynthia D. Lague 30 Jun. 1966 151 p refs
(NAFI-TR-504; AD-635533) CFSTI: HC $4.00/MF $1.00

This report presents a set of tables which give the minimum sample size required to accept a small lot with the probability of acceptance less than or equal to beta for a given LTPD. The tables are based on the hypergeometric probability distribution for lot sizes N of 10(5) 100: beta of 0.01, 0.025, 0.05, 0.10(0.10) 0.90, 0.95, 0.975 and 0.99; and acceptance numbers a of 0(1)3. Author (TAB)

N66-34627*# Columbia Univ., New York. School of Engineering and Applied Science.
A PRIMAL METHOD FOR MINIMAL COST FLOWS WITH APPLICATIONS OF THE ASSIGNMENT AND TRANSPORTATION PROBLEMS Technical Report No. 32

Morton Klein 1 Jun. 1966 33 p refs Sponsored in part by NASA
(Contract Nonr-266(55))
(NASA-CR-77273) CFSTI: HC $2.00/MF $0.50 CSCL 12B

A simple procedure is given for solving minimal cost flow problems in which feasible flows are maintained throughout. It specializes to give primal algorithms for the assignment and transportation problems. Convex cost problems can also be handled. Author

N66-34674*# Research Triangle Inst., Durham, N. C.
A GENERAL METHOD FOR THE CALCULATION OF AXIS-CROSSING MOMENTS Technical Report No. 5
M. Ross Leadbetter Jun. 1966 15 p refs Sponsored in part by NASA
(Contract Nonr-4565(00))
(NASA-CR-77340; SU-181; AD-635139) CFSTI: HC $1.00/MF $0.50 CSCL 12B

The moments of the number of crossings of a level or curve by a stochastic process $\xi(t)$ are obtained, for a wide class of such processes. This extends results of Cramer and Leadbetter, and Ylvisaker to non-normal cases, and provides an alternative derivation to that of Ylvisaker in the normal case. Author

N66-34675*# Case Inst. of Tech., Cleveland, Ohio. Engineering Div.
AN EQUITRIANGULAR INTEGRAL TRANSFORM AND ITS APPLICATIONS
Roy W. Miller and Pau-Chang Lu Jun. 1966 90 p refs
(Contract NGR-36-003-064)
(NASA-CR-77339; FTAS/TR-66-6) CFSTI: HC $3.00/MF $0.75 CSCL 12A

An integral transform is established to facilitate the solution of boundary value problems of the first kind in an equilateral triangular (equitriangular) region. The differential operator (of order 2n) of the problem contains only powers of the Laplacian ∇^2. The boundary values are zero in terms of $(\nabla^2)^i$, where $i=0, 1, 2, \ldots (n-1)$. The inhomogeneous terms and the initial conditions, if any, belong to a certain class of functions of which the constant is the most interesting member. After some general discussions, this transform is applied to a number of problems in viscous flow and heat transfer all inside an equitriangular duct. Numerical work has been carried out for these problems to show the roles played by various parameters. Author

N66-34683*# Alabama Univ., University.
TOPOLOGICAL DYNAMICS Interim Report
[1966] 3 p
(Contract NAS8-1646)
(NASA-CR-77382) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Topological dynamics are treated in an applied rather than pure sense. The aspects that are of interest to an applied mathematician are briefly reviewed, and examples are mentioned. N.E.N.

N66-34805*# Stanford Univ., Calif. Dept. of Statistics.
A SOLUTION TO A COUNTABLE SYSTEM OF EQUATIONS ARISING IN MARKOVIAN DECISION PROCESSES Technical Report No. 89
Cyrus Derman and Arthur F. Veinott, Jr. 7 Jul. 1966 15 p refs
(Contract Nonr-225(53))
(NASA-CR-77373; AD-635144) CFSTI: HC $1.00/MF $0.50 CSCL 12B

A system that arises in connection with constructing optimal rules for controlling Markovian decision processes applied to ordering supplies, and conditions are given to insure the existence and uniqueness of an explicit solution. As an illustration of one solution, a single item inventory model is considered in which demands in various periods are independent. A demand of size one occurs with probability p $(0<p<1)$ and a demand of size zero occurs with probability $1-p$. If X_n denotes the stock on hand at the beginning of the period n, an order for one unit is placed in period n with immediate delivery if $X_n=0$; otherwise no order is placed in period n. There is a unit cost for each unit on hand before ordering and a cost item for placing an order. With these conditions the nonzero transition probabilities can be found and the required solution to the problem results. The second solution takes into account the long-run expected cost under the indicated ordering policy. M.W.R.

N66-34809# Wisconsin Univ., Madison. Dept. of Statistics.
GENERALIZED BAYES DECISION FUNCTIONS, ADMISSIBILITY AND THE EXPONENTIAL FAMILY
Mervyn Stone May 1966 12 p refs
(Contract Nonr-1202(00))
(TR-74; AD-634774) CFSTI: HC $1.00/MF $0.50

Three types of generalized Bayes decision functions—NGBDF, EGBDF, CGBDF—are defined and their relationships examined. A sufficient condition is given for the admissibility of a CGBDF. In the context of the exponential family and quadratic loss estimation, a sufficient condition that $X/(\lambda+1)$ be a CGBDF for the mean is shown to be the same as Karlin's condition for the admissibility of $X/(\lambda+1)$. Author (TAB)

N66-34820# Columbia Univ., New York. Dept. of Mathematics.
NON ABELIAN COHOMOLOGY [COHOMOLOGIE NON ABELIENNE]
Jean Giraud [1964] 120 p refs In FRENCH
(Contract Nonr-266(57))
(CU-21-NONR-266(57)-M; AD-635021) CFSTI: HC $4.00/MF $0.75

A systemmatic and detailed study is made of nonabelian cohomology, and a topology as defined by Grothendieck is assumed. The results given are considered applicable to clusters of various kinds. Fiber spaces with structure sheaths are discussed; and second degree cohomology is studied in light of the $H^2(L)$ group attached to an L bond, realizable bonds, and sections of an homogeneous space. Various field on a site are reviewed, and attention is given to U-sites, fiber categories, fields associated with an E-category fiber, and direct and inverted images. A chapter is also devoted to changes in site, topological displays, and fundamental group theorems. Transl. by M.W.R.

N66-34894# RAND Corp., Santa Monica, Calif.
PURE COMPETITION, COALITIONAL POWER, AND FAIR DIVISION
Lloyd S. Sharpley and Martin Shubik Jun. 1966 57 p refs
(Contract AF 49(638)-1700)
(RM-4917-PR; AD-634898) CFSTI: HC $3.00/MF $0.50

A new application of the mathematical theory of games to the conceptual foundations of the theory of economic competition is presented. The memorandum first gives a nontechnical discussion of three different types of solution to mathematical models of the marketplace, namely, the competitive equilibrium, the core, and the value, and relates them to three principles of distribution, namely, pure competition, coalitional power, and fair division. Several models are then

analyzed in detail, first, numerical solutions are calculated for a class of symmetric market games, chosen to contrast the value with the other two solutions. Next, as the number of traders is increased, the convergence of all three solutions to a single outcome is proved for a general class of markets with money. Finally, an illustrative market model without money is evaluated explicitly as a function of the size of the market. This represents the first substantial application of a new definition of the value for games without side payments. The formal definitions are summarized in an appendix.

Author (TAB)

N66-34903# Stanford Univ., Calif. Dept. of Statistics.

THE MAXIMUM DEVIATION OF SAMPLE SPECTRAL DENSITIES Technical Report No. 16

Michael B. Woodroofe and John W. Van Ness 3 Jun. 1966 30 p refs

(Contract DA-ARO(D)-31-124-G726; Grant Nonr-225(52))

(AROD-2025-17; AD-635018) CFSTI: HC $2.00/MF $0.50

The maximum deviation of the sample spectral density from the true one is shown to be relatively stable for a wide class of linear processes. The general case is reduced to the case of pure white noise. Author (TAB)

N66-34906# Northwestern Univ., Evanston, Ill. Dept. of Geology.

A COMPARISON OF POLYNOMIAL AND FOURIER MODELS IN MAP ANALYSIS

William C. Krumbein Jun. 1966 46 p refs

(Contract Nonr-1228(36))

(TR-2; AD-635476) CFSTI: HC $2.00/MF $0.50

The problem of selecting an optimum model for trend-analysis of mapped data involves the question of the structure of a single observation under various models. The commonly used polynomial functions structure the data in such a way that a succession of fitted surfaces, linear, quadratic, cubic, etc., can be constructed. The less commonly used but increasingly popular fourier series model structures the data to produce a series of harmonic surfaces having wave forms of diminishing wave length as the order of the surface rises. Present implications appear to be that when the map shows cyclical forms, the fourier model is to be preferred. The general problem, however, also includes the question of extrapolating the map beyond the limits of control, and in this respect the polynomial and fourier models differ very markedly. The present report is an expository study, in which a given set of gridded map data is analyzed with both models, and some of the resulting maps are compared. These maps are then extrapolated beyond the grid, and they demonstrate for the example chosen that extrapolation for short distances from low-order polynomial surfaces is more satisfactory than extrapolation from fourier maps. However, as the order of the polynomial surface rises, the extrapolated values rapidly increase or decrease beyond bound, whereas fourier maps of all orders display periodic repetition of the pattern in the control grid. Author (TAB)

N66-34927*# General Precision, Inc., Little Falls, N. J. Mathematics Dept.

FINITE TIME STABILITY OF PERIODIC SOLUTIONS OF HAMILTONIAN SYSTEMS

I. S. Bernstein *In* NASA. Marshall Space Flight Center Proc. of the 24th Seminar on Space Flight and Guidance Theory 23 Jun. 1966 p 7-23 refs (See N66-34926 20-30) CFSTI: HC $3.00/MF $1.00

This study deals with finite time stability properties of periodic solutions of Hamiltonian systems. It attempts to answer questions such as what tube of initial conditions about the periodic solution will keep solutions in some prescribed tube about the periodic solution over some prescribed time interval. A theoretical basis for answering questions such as the one formulated above was given by Birkhoff. However, to obtain actual numerical estimates from the analytical theory requires a great deal of algebraic manipulation, even in the simplest of problems. For this reason, it was decided to employ a computer and an appropriate computer language to perform the required manipulations. As an initial application of the mechanization of the Birkhoff theory the system chosen was the planar restricted three-body problem and the solution chosen was a Lagrangian critical point. Author

N66-34931*# Brown Univ., Providence, R. I. Center for Dynamical Systems.

STABILITY CRITERIA FOR N-TH ORDER, HOMOGENEOUS LINEAR DIFFERENTIAL EQUATIONS

E. F. Infante *In* NASA. Marshall Space Flight Center Proc. of the 24th Seminar on Space Flight and Guidance Theory 23 Jun. 1966 p 91-110 refs (See N66-34926 20-30) CFSTI: HC $3.00/MF $1.00

(Contract NAS8-11264)

Homogeneous linear differential equations are evolved for real continuous functions; and appropriate criteria for the stability of the origin are dependent upon the behavior of the functions but not their derivatives. The second method of Liapunov is used to obtain stability criteria depending on only n parameters which determine a family of elliptic paraboloids in the n-dimensional space. It is shown that these paraboloids completely contain the hyperellipsoids of Ghizetti. A practical technique for the application of the derived stability criteria is given by two examples. M.W.R.

N66-34932*# Brown Univ., Providence, R. I. Center for Dynamical Systems.

AN INVARIANCE PRINCIPLE IN THE THEORY OF STABILITY

J. P. La Salle *In* NASA. Marshall Space Flight Center Proc. of the 24th Seminar on Space Flight and Guidance Theory 23 Jun. 1966 p 111-129 refs (See N66-34926 20-30) CFSTI: HC $3.00/MF $1.00

(Contract NAS8-11264; Grant NGR-40-002-015; Contract DA-31-124-ARO(D)-270; Grant AF-AFOSR-693-65)

A unified presentation of Liapunov's theory of stability is given that considers both the classical Liapunov theorems of stability and instability as well as their extensions. This produces some new results for dynamical systems, and it is hoped that these results will have utility for special types of dynamical systems defined by partial differential equations. Basic results for ordinary differential equations are also included; and a fundamental stability theorem for nonautonomous systems, which is a modified version of a theorem of Yoshizawa, is solved. An example indicates that the conclusion of this theorem is the best possible; however, sharper results can be obtained whenever the limit sets of the solution are known to have an invariance property. Results are also included for autonomous functional differential equations, as well as for theorems which permit estimates of regions of attraction (or asymptotic stability) for nonautonomous systems. M.W.R.

N66-34944# System Development Corp., Santa Monica, Calif.

MATHEMATICAL MODELS OF SYNONYMY

H. P. Edmundson 14 Jun. 1966 21 p refs Presented at the 1965 Intern. Conf. on Computational Linguistics, New York, 19-21 May 1965

(SP-1976/000/01; AD-635202) CFSTI: HC $1.00/MF $0.50

A historical summary is made of the concepts of synonymy and antonymy. The roles of part-of-speech and context of a word are considered. The concept of a synonym of a word is shown to require the use of a ternary relation rather than that of a binary relation. Synonymy is defined implicitly, rather than explicitly, by three axioms that lead to equivalence classes. Antonymy is defined implicitly by another set of three axioms. Several algebraic, geometrical, and topological models of synonymy and antonymy are posed and examined.
Author (TAB)

N66-34957# Boeing Scientific Research Labs., Seattle, Wash. Mathematical Research Lab.
A COMPARISON OF PRIMAL AND DUAL METHODS OF LINEAR PROGRAMMING
Victor Klee Apr. 1966 20 p refs *Its* Math. Note No. 459
(D1-82-0520; AD-634903) CFSTI: HC $1.00/MF $0.50

Both primal and dual methods of linear programming consist of relatively efficient ways of searching among certain sets of points for one at which an extreme value of a linear form is attained. For a given problem the primal search is applied to one set of points and the dual search to another set. The possible cardinalities of these sets are compared for guidance as to which method is preferable in various circumstances. Let $\pi(d,n)$ and $\Pi(d,n)$ denote respectively the minimum and the maximum of the cardinality of the set to which the primal search is applied, when the feasible region is a d-dimensional polyhedron having n facets and reasonable nondegeneracy conditions are satisfied. Let $\delta(d,n)$ and $\Delta(d,n)$ be similarly defined for dual searches. Various results on these numbers are obtained, leading in particular to the conjecture that $\Pi(d,n) \leq \Delta(d,n)$ when $n \geq 2d$, while $\Pi(d,n) \geq \Delta(d,n)$ when $n \leq 2d$.
Author

N66-35077# RAND Corp., Santa Monica, Calif.
SUCCESSIVE APPROXIMATION BY QUADRATIC FITTING AS APPLIED TO OPTIMIZATION PROBLEMS
S. P. Azen Jun. 1966 30 p refs
(Contract AF 49(638)-1700; Proj. Rand)
(RM-5001-PR; AD-635282) CFSTI: HC $4.00/MF $0.50

This memorandum investigates a technique of solving optimization problems by expanding the original functional about an approximating function to obtain a quadratic function which then can be solved exactly using dynamic programming. Applications and numerical results are presented for a one-dimensional example, a two-point problem, and approximations over a grid of points.
Author (TAB)

N66-35109# Copenhagen Univ. (Denmark).
ATTRIBUTE SAMPLING PLANS BASED ON PRIOR DISTRIBUTIONS AND COSTS
A. Hald May 1966 14 p refs
(Contract N62558-3073)
(AD-635451) CFSTI: HC $1.00/MF $0.50

The model considered in based on a differentiable prior distribution. A general loss function, an operating characteristic written as an Edgeworth expansion, and sampling costs expressible as a polynomial in the sample size. Asymptotic expressions from the Bayesian single sampling plan are derived and it is shown how previously known results may be found as special cases of the present one. The efficiency of non-optimum plans is discussed.
Author (TAB)

N66-35132# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
SOME INTEGRAL PROPERTIES OF LEGENDRE POLYNOMIALS [ALCUNE PROPRIETA INTEGRALI DEI POLINOMI E DELLE FUNZIONI ASSOCIATE DI LEGENDRE]
R. Biancastelli and S. Francaviglia 30 May 1966 22 p refs in ITALIAN; ENGLISH summary
(ISS-66/21) CFSTI: HC $1.00/MF $0.50

This report is devoted to the computation of some definite integrals of products of Legendre polynomials and associated functions, and of some integrals of the type

$$\left[\int_{-1}^{1} x^n P_l^m(x)\,dx\right]$$

Author

N66-35149# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrical Engineering.
APPLICATION OF CONSENSUS THEORY TO THE MINIMIZATION OF BOOLEAN FUNCTIONS
Pierre Tison Jun. 1966 43 p refs
(Contract AF 49(638)-1402)
(PIBMRI-1330-66; AD-634800) CFSTI: HC $2.00/MF $0.50

Given two implicants of a Boolean function, we can by performing their consensus, find a third implicant. This operation has been used for finding the prime implicants of a Boolean function. In this paper, the consensus is extended from two to any number of terms. A property of these generalized consensus relations leads to a systematic way of finding them. It is shown that any prime implicant of a Boolean function is a generalized consensus. Therefore the algorithm for the determination of the consensus relations can be used for finding the prime implicants. This new method is simpler than the usual process of iterative consensus. It is also shown in this paper that consensus theory can be used for finding the minimal sums of a Boolean function. The methods are applicable for any Boolean function, with or without don't care conditions, with a single or a multiple output.
(TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-34187# White Sands Missile Range, N. Mex. Meteorological Support Div.
HONEST JOHN MISSILE NO. 3906, ROUND NO. 5013 RBL (15 FEB. 1966) Meteorological Data Report
Jun. 1966 14 p
(DR-19; AD-634360) CFSTI: HC $1.00/MF $0.50

Meteorological data gathered for the launching of Honest John, missile number 3906, round number 5013 RBL, are presented in tabular form.
Author (TAB)

N66-34211# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
NIKE-APACHE STV (SR-031) (24 MAY 1966) Meteorological Data Report
Gordon L. Dunaway Jun. 1966 30 p
(DR-37; AD-634066) CFSTI: HC $2.00/MF $0.50

Meteorological data collected for the launching of Nike-Apache STV (SR-031) are presented for the Ballistic Systems Division, U.S. Air Force, and for future ballistic studies. The meteorological data and resulting ballistic data appear in tabular form. Author (TAB)

N66-34213# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
396 LANCE MISSILE NO. 028, ROUND NO. 19 RSL (29 APRIL 1966) Meteorological Data Report
Jun. 1966 36 p
(DR-27; AD-634067) CFSTI: HC $2.00/MF $0.50

Meteorological data gathered for the launching of 396 Lance Missile #028, round number 19 RSL, are presented in tabular form. Author (TAB)

N66-34249# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
LITTLE JOHN MISSILE NO. 1054, ROUND NO. 644 AM (21 APRIL 1966) Meteorological Data Report
Jun. 1966 25 p
(DR-25; AD-634777) CFSTI: HC $1.00/MF $0.50

Meteorological data gathered for the launching of Little John, missile number 1054, round number 644 AM, are presented in tabular form. Author (TAB)

N66-34256# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
ATHENA FLIGHT NUMBER 042 (27 MAY 1966) AND ATHENA FLIGHT NUMBER 043 (27 MAY 1966) Meteorological Data Report
John M. Sharpe Jun. 1966 75 p refs
(DR-39; AD-634757) CFSTI: HC $3.00/MF $0.75

Meteorological data gathered for the launching of Athena flight number 042, vehicle C-019 and Athena flight number 043, vehicle D-031 are presented for the Air Force Ballistic Missile Re-entry Systems Office and for ballistic studies. The data are presented in tabular form. Author (TAB)

N66-34271# Travelers Research Center, Inc., Hartford, Conn.
BALLISTIC WINDS STUDY Quarterly Report No. 3, Dec. 1965-Mar. 1966
Frederick P. Ostby, Jr. Ft. Monmouth, N. J., Army Electron. Command, Jun. 1966 57 p
(Contract DA-28-043-AMC-01377(E))
(ECOM-01377-3; AD-634237) CFSTI: HC $3.00/MF $0.50

An objective analysis technique known as CRAM (conditional relaxation analysis method) has been programmed for the IBM 7090 to compute ballistic winds, temperature, and density over a region of southeastern Arizona in the vicinity of Ft. Huachuca. The various components and available options of the program are described. A set of analyses produced from initial tests is shown and the ballistic quantities derived are compared with those of the previous quarterly report. Corrections based on a single station (Ft. Huachuca) were applied to concurrent artillery firings for 19 cases. The residual errors derived from these cases will be used as a control for later experiments. The distribution of the residual errors relative to the target strongly suggests a bias in range errors, the average impact location being nearly 200 meters beyond the target. Author (NSA)

N66-34276# Illinois State Water Survey, Urbana.
INVESTIGATION OF THE QUANTITATIVE DETERMINATION OF POINT AND AREAL PRECIPITATION BY RADAR ECHO MEASUREMENTS Interim Report No. 3, 1 Oct. 1965-31 Mar. 1966
E. A. Mueller and A. L. Sims Ft. Monmouth, N. J., Army Electron Command, Jun. 1966 30 p ref
(Contract DA-28-043-AMC-00032(E))
(ECOM-00032-3; AD-634362) CFSTI: HC $2.00/MF $0.50

The results of the drop size sample study indicate that volumes of about 50m^3 are necessary to estimate rainfall rate and radar reflectivity to 10 percent accuracy with 95 percent confidence. One-cubic-meter samples are sufficiently large that rainfall rate-radar reflectivity relationships can be reliably determined. The sample size variances contribute about 10 percent of the logarithmic scatter around the regression line. Analysis of drop size data from Indonesia yielded a reflectivity rate relationship similar to that from Miami, Florida data but with less scatter. Five-minute rainfall rate frequencies from Indonesia were also similar to those from Florida. Author (TAB)

N66-34343# Wyoming Univ., Laramie.
A WIND TUNNEL STUDY OF VELOCITY PROFILES BEHIND A MODEL SNOW FENCE
Warren B. Mc Cormick (M.S. Thesis) Jun. 1966 70 p refs
(Contract AF 33(608)-1295)
(AD-633253) CFSTI: HC $3.00/MF $0.75

The ability of vertical slatted scale model fences of differing heights, with a 50 percent slat density, to prevent unwanted buildup of snow across highways and railways was studied in a wind tunnel. Three different snowdrift configurations were simulated with modeling clay; evaluation of their velocity profile shapes at different positions behind the fences developed the largest acceleration over the top of the drift in all cases. The flow over the drift caused positive or adverse pressure gradients somewhere behind the apex of the drift, and even a fluid motion in the opposite direction after the point of boundary layer separation. Data analyses of the observed velocity values led to the conclusion that the height of the maximal dimensional upstream velocity drift is a function of gap fence height. G.G.

N66-34476# Raven Industries, Inc., Sioux Falls, S. Dak.
HAIL INCIDENCE IN THE TROPICS Final Report
Emily M. Frisby and Hugh W. Sansom (East African Meteorol. Dept.) Sep. 1966 59 p refs *Its* Rept.-0766
(Contract DA-28-043-AMC-02105(E))
(ECOM-02105-F; AD-631696) CFSTI: HC $3.00/MF $0.75

This report is a review and compilation of information concerning the incidence and frequency of hail fall in tropical areas. The authors have gathered the data over a period of years from literary sources and by extensive correspondence with private individuals and government meteorological services. The four areas under which the various hail report are grouped viz. the American, African, Asian and Pacific, and Australian, together form a total band around the equator within latitudes 23-1/2° north and south of it. Attempts have been made to systematize presentation of the information. This is only possible up to a point however, since it was received in a multiplicity of forms, some of which defy conventional climatological handling. Nevertheless the report makes possible for the first time a comprehensive assessment of the tropical hail phenomenon. Moreover a great deal can be learned from it about seasonality of hail fall in specific areas and about the occurrence of hail at sea level and over the sea, facts which have been in question up to this time. Author (TAB)

N66-34477# Raven Industries, Inc., Sioux Falls, S. Dak. Meteorology Dept.
LIGHT WINDS IN THE STRATOSPHERE (15-24 km), PART 3
Emily M. Frisby, R. K. Engel, and L. V. Nelson Sep. 1965 120 p refs
(Contract Nonr-4347(00))
(Rept.-0266; AD-629524) CFSTI: HC $4.00/MF $0.75

This report does no theorizing. It emphasizes those stratospheric characteristics that can be of value operationally and aims at presenting a large volume of observational material in such form that it can be used directly from maps and diagrams, without further processing. Although the number of diagrams shown in the report as examples of each study is large, it represents by no means the total amount of data-processing that has been done under this latest phase of the contract. Results quoted are based on a review of all the data processed. The entire collection of working sheets is available at Raven Industries, Inc. on request.
Author (TAB)

N66-34604# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
ATHENA FLIGHT NUMBER 044 (9 JUNE 1966) AND ATHENA FLIGHT NUMBER 045 (10 JUNE 1966) Meteorological Data Report
Gordon L. Dunaway Jul. 1966 58 p refs
(DR-44; AD-635115) CFSTI: HC $3.00/MF $0.50

Meteorological data gathered for the launching of Athena Flight #044, Vehicle #D-021, and Athena Flight #045, Vehicle #D-023 are presented for the Air Force Ballistic Missile Reentry Systems Office and for ballistic studies. The data are presented in tabular form.
Author (TAB)

N66-34640*# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE NASA 4.95 GS Meteorological Data Report, 20 May 1966
Gordon L. Dunaway Ft. Monmouth, N. J., Army Electron. Command, Jun. 1966 34 p refs Prepared for NASA
(NASA-CR-77312; DR-34; AD-634696) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Meteorological data gathered for the launching of Aerobee NASA 4.95 GS are presented for the National Aeronautics and Space Administration for ballistic studies. The data appear, along with calculated ballistic data, in tabular form.
Author (TAB)

N66-34801*# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE NASA 4.144 DG (NRL NB 3.165) (18 JULY 1966) Meteorological Data Report
Marjorie Mc Lardie Hoidale Ft. Monmouth, N. J., Army Electron. Command, Aug. 1966 40 p refs
(NASA-CR-77332; DR-58) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Meteorological data gathered for the launching of Aerobee NASA 4.144 DG are tabulated along with calculated ballistic data. Theoretical rocket performance values are given, and actual and predicted launch data are compared. Wind data for the first 4000 ft above the surface were obtained from a double-theodolite wind velocity computer system, and balloons released at the launch site were observed and tracked from a 2000-ft baseline. Temperature, pressure, and humidity data; and upper wind data from 4000 to approximately 100,000 ft above the surface were obtained from standard rawinsonde operations. Mean wind component values in each ballistic zone were determined from vertical cross sections by an equal-area method. Ballistic factors, impact prediction data, and impact data are included in the tabulations.
M.W.R.

N66-34802*# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE NASA 4.159 GG (15 JULY 1966) Meteorological Data Report
Marjorie Mc Lardie Hoidale Ft. Monmouth, N. J., Army Electron. Command, Aug. 1966 33 p refs
(NASA-CR-77331; DR-56) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Meteorological data used in conjunction with theoretical calculations to predict rocket impact as well as ballistics data are tabulated for the Aerobee NASA 4.159 GG. Wind data for the first 4,000 ft above the surface were obtained from a double-theodolite wind velocity computer system, and balloons released at the launch site were observed from a 2,000-ft baseline. Temperature, pressure, and humidity data; and upper wind data from 4,000 to approximately 100,000 feet above the surface were obtained from standard rawinsonde operations. Mean wind component values in each ballistic zone were determined from vertical cross sections by an equal-area method. Actual and predicted launch data for this Aerobee rocket are compared.
M.W.R.

N66-34810# Inter-Range Instrumentation Group, White Sands Missile Range, N. Mex.
FORT CHURCHILL MISSILE RANGE REFERENCE ATMOSPHERE FOR FORT CHURCHILL, CANADA, PART I
Dec. 1964 87 p refs
(IRIG-104-63; AD-634727) CFSTI: HC $3.00/MF $0.75

The IRIG range reference atmosphere, which is presented in this document, is one in a series to be published by the Inter-Range Instrumentation Group/Meteorological Working Group. Part I contains an explanation of the basic data, computational procedures, and the resulting values tabulated for altitude intervals between mean sea level and 30 km altitude. Monthly and annual thermodynamics values and wind quantities are tabulated. The thermodynamic quantities are height (GPM), pressure (KG F M/2) pressure (MB), temperature (K), virtual temperature (K), density (G M/3), speed of sound (M sec/1), relative humidity (%), and vapor pressure (MB) tabulated at 250 M intervals of geometric altitude. The wind quantities are scalar wind, zonal and meridional component values (M/sec) for eleven cumulative percentage frequency levels tabulated at 1 km intervals from 0 to 27 or 30 km altitude. A separate document for part I will be issued for each of the several IRIG range reference atmospheres. Author (TAB)

N66-34811# Inter-Range Instrumentation Group, White Sands Missile Range, N. Mex.
FORT GREELY MISSILE RANGE REFERENCE ATMOSPHERE, PART I
Nov. 1964 88 p refs
(IRIG-104-63; AD-634726) CFSTI: HC $3.00/MF $0.75

The IRIG range reference atmosphere, which is presented in this document, is one in a series to be published by the Inter-Range Instrumentation Group/Meteorological Working Group. Part I contains an explanation of the basic data, computational procedures, and the resulting values tabulated for altitude. Monthly and annual thermodynamic values and wind quantities are tabulated. The thermodynamic quantities are height (GPM), pressure (kg f m/2), pressure (mb), temperature (k), virtual temperature (k), density (g m/3), speed

of sound (m sec/1), relative humidity (%), and vapor pressure (mb) tabulated at 250 m intervals of geometric altitude. The wind quantities are scalar wind, zonal and meridional component values (m/sec) for eleven cumulative percentage frequency levels tabulated at 1 km intervals from 0 to 27 or 30 km altitude. A separate document for part I will be issued for each of the several IRIG range reference atmospheres.
Author (TAB)

N66-34812# Texas Univ., Austin. Atmospheric Science Group.
DETERMINATION OF WINDS FROM METEOROLOGICAL ROCKETSONDES
Amos Eddy, C. E. Duchon, F. M. Haase, and D. R. Haragan Nov. 1965 34 p refs
(Contract DA-23-072-AMC-1564)
(Rept.-2; AD-635185) CFSTI: HC $2.00/MF $0.50

The equations of motion are derived for an object falling under the influence of gravity and aerodynamic drag. These equations are used to examine the response of the ARCAS parachute to hypothetical wind profiles in the region extending from 30 to 80 km. A computational scheme for determining the horizontal wind from the observed motion of any wind sensor influenced only by the above forces is presented, along with an example of its application to an ARCAS parachute flight. Author (TAB)

N66-35119# Massachusetts Inst. of Tech., Cambridge.
APPLICATION OF RADAR TO MEASUREMENT OF SURFACE PRECIPITATION Semiannual Report, 1 Sep. 1965–31 Mar. 1966
Pauline M. Austin Ft. Monmouth, N. J., Army Electron. Command. Apr. 1966 15 p
(Contract DA-28-043-AMC-01472(E))
(ECOM-01472-1; AD-634983)

Investigation of the application of radar to the measurement of surface precipitation includes assessment of the accuracy of radar measurements, development of new instrumentation and techniques, observations of storms, and analysis and interpretation of the data. The program comprises four tasks, and work in each during the past six months is described. *Instrumentation:* A relatively new AN/CPS-9 radar, obtained through ECOM, and a new 10 cm radar, obtained under a grant from National Science Foundation, have been installed at the Center for Earth Sciences. The 10 cm radar is not yet in operation as cabling and connections are not complete. The timing system and a digital sweep integrator for the new radar have been built under this contract and are nearly ready to be incorporated into the system. *Observations:* Radar data were taken in 17 storms for approximately 100 hours. Raindrop samples were obtained on five days. *Data Processing:* No major data processing program is in progress at this time. *Applications and Analysis:* Four investigations currently in progress are described: (1) Computed particle-size distributions resulting from the aggregation of snow crystals; (2) Mesoscale precipitation patterns and their relation to macroscale parameters; (3) Water content and structure of thunderstorms; and (4) Location of air mass thunderstorms in relation to local topographical features. Author (TAB)

N66-35121# Army Foreign Science and Technology Center, Washington, D. C.
BWR-X12 GROUND WEATHER RECONNAISSANCE RADAR [NAZEMNAYA RADIOLOKATSIONNAYA STANTSIYA DLYA RAZVEDKI POGODY]
Jun. 1966 14 p
(FSTC-HT-23-106-66; AD-634795) CFSTI: HC $1.00/MF $0.50

This is the manufacturers brochure (in Russian) for the East German-made BWR-X12 ground-based weather reconnaisance radar set. Applications, performance, weights, echo-suppression features are described. Author (TAB)

N66-35160# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
EARLY STAGE OF TORNADO DEVELOPMENT AS REVEALED BY SATELLITE PHOTOGRAPHS
Tetsuya Fujita Jan. 1966 24 p refs
(Grants Cwb WBG-41; Cwb WBG-34)
(SMRP-RP-50; PB-169-652) CFSTI: $1.00

About 20 min. after the first of a series of Palm Sunday tornadoes of April 11, 1965 formed in extreme eastern Iowa, TIROS IX, in northbound semi-polar Orbit No. 960, took pictures of the midwestern United States. Though the area of the tornado formation was too far from the exposure subpoint to be examined in detail, a vast region of southwesterly flow behind the cold front extending from Iowa to Arkansas was photographed with relatively small nadir angles of view. Of great interest was a faint, cirrus-like streak inside a large clear area behind the front, which, it was concluded, was a dust storm limiting visibility to less than two miles in some areas. Thermodynamical structure of the dry cold air in which the dust storm was embedded will be discussed in detail in connection with its role in giving rise to the development of the Palm Sunday tornadoes. Author

N66-35201# Joint Publications Research Service, Washington, D. C.
SOME RESULTS AND PROSPECTS OF SCIENTIFIC WORK AT INSTITUTES OF THE HYDROMETEOROLOGICAL SERVICE (1965–1966)
Ye. K. Fedorov 29 Aug. 1966 19 p Transl. into ENGLISH from Meteorol. i Gidrol (Moscow), no. 6, 1966 p 3–11
(JPRS-37279; TT-66-33708) CFSTI: $1.00

The functions of the Hydrometeorological Service are briefly outlined, and the projects being conducted by such institutions as the Scientific Council on Climate and Agrometeorological Resources are reported. The development of statistical and synoptic methods of long-range weather forecasting is mentioned, and the use of hydrodynamic equations in short-range predictions is discussed. Other topics reported on include forecasts of recommended courses for vessels crossing the Atlantic Ocean, artificial weather modification, relation of harvest to meteorological factors, water balances and water resources, contamination and self-purification of water, and landslides and mudflows. It was pointed out that a clear determination of the need of the national economy is necessary and the an overall plan for scientific research in meteorology and hydrology should be delineated. L.E.W.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-34483# Institute of Modern Languages, Washington, D. C.
STABILITY OF THE MOTION OF SOME CONTROLLED GYROSCOPIC DEVICES ON A MOBILE BASE

V. V. Krementulo Jun. 1966 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. (Moscow), no. 2, Mar.–Apr. 1965 p 69–80
(Contract DA-44-009-AMC-1563-T)
(ERDL-T-1841; TT-66-61533; AD-634515) CFSTI: HC $1.00/MF $0.50

The problems of the stability of a spherical gyrovertical with aerodynamic suspension and of a gyrohorizon compass are investigated in the presence of dissipative forces in the case were V, Omega, and H are not constants, constituting certain functions of time. Author (TAB)

N66-34576*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF REACTION WHEELS AND NONLINEAR CONTROL FOR A SATELLITE SCANNING A SMALL CELESTIAL AREA
Frederick G. Edwards Washington, NASA, Aug. 1966 53 p refs
(NASA-TN-D-3592) CFSTI: HC $2.00/MF $0.50 CSCL 17G

Several schemes have been studied for controlling the raster scanning maneuver of a satellite system scanning a small celestial area. The control torque is supplied by an inertia wheel in combination with a torque motor. The entire satellite maneuvers in two phases, a scanning phase and a turn-around phase at the end of each scan line. The study of the scanning phase considers a single control loop with various modifications to the controller component of the loop. The scanning system was analyzed on the basis of response to large disturbances, tracking accuracy, and performance degradation due to the buildup of inertia wheel momentum. A theoretical investigation, indicates that the system with either the linear or dual-mode controller can perform the high precision scan required. Vehicle turnaround performance was found to be very sensitive to the geometry of the command input signal. The effect of inertia wheel saturation was found to be pronounced during scan and turnaround. Various procedures are presented to compensate for this loss in performance. Author

N66-34798*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
BASIC STUDIES IN SPACE VEHICLE ATTITUDE CONTROL Tenth Semiannual Status Report, Period Ending Jun. 1966
I. Flugge-Lotz and R. H. Cannon, Jr. [1966] 17 p refs
(Grant NsG-133-61)
(NASA-CR-77363) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Summaries are presented of continuing research on nonlinear optimal control of planet-pointing space vehicles, basic methods for optimal attitude control, and satellite orbits. Individual reports deal with control of pitch motion of a satellite in elliptic orbit, the validity of linearization in attitude control, optimal control, computations based on second variations, rigorous error bounds on position and velocity in satellite orbit theories, and libration-point satellites. M.W.R.

N66-35018*# United Aircraft Corp., East Hartford, Conn. Research Labs.
LOW-THRUST GUIDANCE STUDY Final Report
W. R. Fimple and C. P. Van Dine Jul. 1966 76 p refs
(Contract NAS8-20119)
(NASA-CR-77406; E-910350-11) CFSTI: HC $3.00/MF $0.75 CSCL 17G

A computer algorithm was developed for determining minimum-time Earth–Mars trajectory where the planets are pulsion systems operating in an inverse-square gravity field. The two-point boundary value variational problem is resolved at a number of updating points throughout the trip with the present observed state supplying the new initial boundary conditions. It was found that these updating points must be more frequent as the trip progresses. The algorithm was applied in a guidance study involving a nominal 268-day minimum-time Earth–Mars trajectory where the planets are considered to be massless points. The most important finding of this study was the high sensitivity of the control to small guidance errors in the final phase of the trip. Applications of the algorithm to low-thrust planetocentric flight were limited to establishing nominal trajectories and associated control programs. A discussion of the same problem in the time-varying field generated by the sun and planets considered at point masses is also presented, including the variational formulation and an adaptation of the algorithm to accommodate variable mesh-point spacing. Author

N66-35089# Boston Coll., Chestnut Hill, Mass. Research and Analysis Lab.
ASPECT OF A ROCKET FROM GYROSCOPIC DATA Scientific Report No. 3
Rene J. Marcou and Paul N. Pruneau 12 Apr. 1966 87 p refs
(Contract AF 19(628)-4178)
(AFCRL-66-349; AD-635014) CFSTI: HC $3.00/MF $0.75

Formulas are derived which determine the aspect of a rocket, the angle of attack of the rocket axis with respect to the velocity vector or any other given vector, the aspect of any vector perpendicular to the rocket axis, and the angle of attack of such a vector with respect to the velocity vector or any other given vector. The aspect of the rocket axis and vectors perpendicular to the rocket axis are expressed in terms of direction cosine angles, azimuth, and elevation. The attack angles are then obtained as functions of the direction cosines. The parameters describing the behavior of a rocket in flight are given as functions of the yaw and pitch of the rocket axis, the spin of the rocket, and the flight time. The inputs are the trajectory data and the yaw, pitch, and roll data in digital form. A general computer code is developed which is capable of automatically processing the input data to provide the flight parameters as functions of the flight time. To demonstrate the system developed, the flight parameters of a specific rocket flight are reduced from data generated by Whittaker 'Mars' roll stabilized two axis gyro on board the rocket. The trajectory data for the rocket is taken from radar beacon data. The 7044 computer program for this system and the resulting output data are exhibited. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-34088# General Electric Co., Cincinnati, Ohio. Atomic Products Div.
HIGH-TEMPERATURE MATERIALS PROGRAMS, PART A Fifth Annual Report, 31 Jan. 1965–31 Jan. 1966
28 Feb. 1966 323 p refs
(Contract AT(40-1)-2847)
(GEMP-400A) CFSTI: HC $6.00/MF $1.50

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4. REFRACTORY-METAL ALLOY RESEARCH AND DEVELOPMENT p 109–133 refs (See N66-34090 20-17)
5. OXIDATION-RESISTANT FUEL ELEMENT MATERIALS RESEARCH p 135–163 refs (See N66-34091 20-22)
6. PHYSICO-CHEMICAL STUDIES OF Fe–Cr–Al-CLAD FUEL SYSTEMS p 165–167 refs (See N66-34092 20-22)
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8. EVALUATIONS OF THE PLASTIC FATIGUE PROPERTIES OF HEAT RESISTANT ALLOYS p 185–201 refs (See N66-34094 20-17)
9. PHYSICO-CHEMICAL STUDIES OF CLAD UO_2 IN POTENTIAL MELTDOWN ENVIRONMENTS p 203–220 refs (See N66-34095 20-22)
10. RADIATION EFFECTS IN BeO p 221–262 refs (See N66-34096 20-18)
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N66-34089# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

FISSION PRODUCT TRANSPORT PROCESSES IN REFRACTORY-METAL FUEL SYSTEMS

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 99–107 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Fission product transport processes in refractory-metal fuel systems investigated in inert and reducing atmospheres at temperatures exceeding 1700°C. Major areas of study were: (1) diffusion of rare gases (Kr 85) in arc-cast Mo, Ta, W, and W-30Mo-25Re; (2) permeation of Kr 85 through arc-cast Ta; (3) migration and release of fission products from irradiated refractory-metal cans containing fuel, and (4) effects of fission product impurity atoms on mechanical properties of refractory materials. Diffusion of Kr 85 in arc-cast Ta at 1400 to 1800°C indicates a short-range transport for most of the Kr 85 of 500 to 1000 Å along high diffusivity paths such as grain boundaries and dislocations; even though there is substantial grain, there is no evidence of Kr 85 penetration of the samples, and fission products will be impregnated in tungsten creep samples in-pile at temperatures to approximate the conditions in a refractory-metal fuel element. M.W.R.

N66-34091# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

OXIDATION-RESISTANT FUEL ELEMENT MATERIALS RESEARCH

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 135–163 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Fuel element materials for use at high temperatures in air, steam or other oxidizing coolants were investigated in terms of improving their high temperature capabilities, service life, and containment of fission products. At 950 and 1100°C, Cr-matrix fueled cores are more reactive with cladding than Fe-matrix cores; the UN and UO_2 fueled specimens are found to compare favorably at 950°C; but at 1100°C, UN and spheroidized UO_2 show higher reactivities with cladding than do ceramic-grade or agglomerated forms of UO_2. Several specimens of varying composition achieved 10,000 hours in air at both temperatures; and one clad Fe-UO_2 passed the 11,000 mark. Uranium diffusion through Fe-Cr-Al-Y cladding after 10,000 hours is less in Fe-UO_2 systems than in Cr-UO_2. Air oxidation resistance of the Fe-Cr-Al-Y alloys is relatively independent of Cr concentration, and resistance to stream corrosion is reduced as Cr concentration is reduced. Studies indicate that alloys retain their high temperature ductility after neutron exposure, and effects of irradiation appear to be gone after annealing at a temperature of about 350°C. M.W.R.

N66-34092# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

PHYSICO-CHEMICAL STUDIES OF Fe-Cr-Al-CLAD FUEL SYSTEMS

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 165–167 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

Testing is underway to determine the physico-chemical reactions which can occur between oxidant-resistant Fe-Cr-Al alloys and UO_2 at temperatures between 500 and 1200°C. These include phase, diffusion, and thermodynamic studies as well as fueled capsule tests. M.W.R.

N66-34095# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

PHYSICO-CHEMICAL STUDIES OF CLAD UO_2 IN POTENTIAL MELTDOWN ENVIRONMENTS

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 203–220 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

When heated at 0.3°C per second, Zircaloy in steam produces a three-layered structure consisting of an outer layer of ZrO_2, an intermediate layer of ZrO_{2-x} and an inner layer of metal. The intermediate layer contains tin or a tin-rich alloy which probably does not oxidize in steam because water is more stable than tin oxides at the temperatures used. Isothermal corrosion of Zircaloy with steam at temperatures of 1200 and 1400°C is approximately parabolic with time, and activation energy is calculated to be about 38 kcal/mole. At the relatively low heating rate of 0.3°C per second, Type 304 stainless may bloat upon melting after being subjected to water vapor corrosion and heated to melting point. Molten Zircaloy and UO_2 react relatively rapidly at temperatures of 1900°C and above; and upon cooling, the reaction products appear to be predominantly metal or a metallic phase in addition to ZrO_{2-x}. This reaction rate appears to be much slower than the Zircaloy steam oxidation reactions at similar temperatures. M.W.R.

N66-34097# General Electric Co., Cincinnati, Ohio. Atomic Products Div.

HIGH-TEMPERATURE THERMOCOUPLES AND ELECTRICAL MATERIALS RESEARCH

In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 263–268 ref (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

In order to develop instrumentation and electrical components for long-life, high temperature reactors and reactor experiments, the properties of high-temperature thermocouples and electrical and electronic materials were investigated. Development of high-temperature insulator materials is discussed, as well as reactor testing of thermocouples, high-temperature metal-to-ceramic and graded seals, and diffusion studies of niobium-to-lucalox bonds. Resistivity of ThO_2, found to be a function of oxygen partial pressure and temperature, was approximately two orders of magnitude smaller than for BeO. The low activation energy of BeO, however, was considered to indicate that small amounts of impurities were controlling resistivity. M.W.R.

N66-34098# General Electric Co., Cincinnati, Ohio. Atomic Products Div.
INTERNAL CONVERSION CERAMIC FUEL ELEMENT RESEARCH
In its High-Temp. Mater. Programs, Pt. A 28 Feb. 1966 p 269-278 refs (See N66-34086 20-22) CFSTI: HC $6.00/MF $1.50

The advantages of UO_2-ThO_2-Y_2O_3 fuels in BeO as compared to UO_2 fuels alone are considered in terms of extending reactor lifetime or increasing removable energy. Experimental results of the BeO-base fuels show that they have adequate physical and mechanical properties for extended service in internal conversion reactor systems and that their thermal stability is excellent. Such fuel elements appear to be capable of 15,000 hours life in air at 1200°C with 1% loss, or at 1400°C with 2% loss, their capability in gas coolants is better than in air coolants. Small additions of Y_2O_3 to uranium-thorium oxide fuels are desirable to obtain maximum fuel retention capability. After extended fuel retention tests to 5000 hours and temperatures up to 1650°C, the physical integrity of all the fuel elements remains essentially unchanged. Irradiation of BeO containing 25% fuel caused no significant deterioriation in physical and mechanical properties, and no change in appearance or microstructure. M.W.R.

N66-34139# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NEUTRON TRANSPORT CALCULATIONS ON AIR FORCE NUCLEAR ENGINEERING TEST REACTOR
David R. Floyd (M.S. Thesis) Mar. 1966 93 p refs
(GSP/PHYS-66-5; AD-634563) CFSTI: HC $3.00/MF $0.75

Neutron transport flux calculations are performed on the test cells of the Air Force Institute of Technology nuclear engineering test facility at Wright-Patterson Air Force Base, Ohio. The calculations are performed by a computer code, written by the author, which uses a three energy group. Discrete S-4 approximation of the Boltzmann transport equation in XY-geometry. An iterative procedure having the total fission source production as the Eigenvalue is used by the computer code to solve the derived discrete sn difference equations numerically. The code is written in Fortran IV language for the IBM 7094 coupled system. The results obtained by the code calculations are compared with the results from gold foil experiments. These results are in good agreement.
Author (TAB)

N66-34162# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME POSSIBILITIES OF METHOD OF EDDY CURRENTS FOR MULTIPARAMETER CHECKING OF ELEMENTS OF CONSTRUCTIONS
V. G. Vyakhorev, V. G. Gerasimov, V. P. Deniskin, L. I. Trakhtenberg, and Yu. M. Shkarlet 28 Jan. 1966 23 p refs Transl. into ENGLISH of the Monograph "Nekotoryye Vozmozhnosti Metoda Vikhrevykh Tokov Dlya Mnogoparametrovogo Kontrolya Elementov Konstruktsiy" Presented at the Symp. on Nondestructive Testing of Mater. in Nucl. Eng., Bucharest 17-21 May 1965 p 1-26
(FTD-MT-65-563; TT-66-61395; AD-633643) CFSTI: HC $1.00/MF $0.50

The report contains the results obtained in connection with the application of the method of eddy currents for multiparameter checking in certain areas of nuclear technology.
TAB

N66-34300# Air Force Inst. of Tech., Wright-Patterson afb, Ohio. School of Engineering.
A CRITICALITY ANALYSIS OF THE ROMASHKA REACTOR
William Mark Hodgson (M.S. Thesis) Jun. 1966 95 p refs
(GSP/PH/66-10; AD-634506) CFSTI: HC $3.00/MF $0.75

A criticality analysis is performed on the Romashka reactor in an effort to establish the critical fuel loading and flux distribution. The analysis is in support of a complete engineering study designed to confirm or refute data on the Romashka configuration. Transport theory is used because of the small size and many interdependent regions of the system. a conservative S_n equation is derived from the Boltzman transport equation. The equation is solved using rotational invariant quadrature for the differenced angular dependence. A code, RZSN, was written, and another code, TDSN, was used. Calculations were made using Hansen and Roach sixteen group cross sections with TDSN, and three group cross sections with RZSN. 49.00 and 71.08 kg. U^{235} loadings were found to be supercritical with TDSN. A critical mass of 55.87 kg. is predicted with RZSN. Discrepancies are found between 'known fuel loading and 'known' physical dimensions. The validity of the results is discussed, and directions for further investigation indicated.
Author (TAB)

N66-34602# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE MAXIMUM FUEL ELEMENT LOADING OF THE AIR FORCE NUCLEAR ENGINEERING TEST FACILITY
Phillip Arthur Terry (M.S. Thesis) Mar. 1966 205 p refs
(GSP/PH/66-19; AP-635041) CFSTI: HC $6.00/MF $1.25

The maximum fuel element loading for the third core of the Air Force Nuclear Engineering Test Facility at Wright-Patterson Air Force Base, Ohio, was calculated. The effects of several fuel element loadings were evaluated using a two-dimensional, burn-up code on the 7094 computer. The criteria used in the evaluation were limits on the excess reactivity, the thermal stress, and the materials of the reactor. The 250 gm fuel element loading was found to be the maximum fuel element loading for the third core.
Author (TAB)

N66-34605# Armed Forces Radiobiology Research Inst., Bethesda, Md.
THE NUMERICAL EVALUATION OF THE THEORETICAL VARIANCE/MEAN RATIO OF THE NEUTRON POPULATION IN THE SUBCRITICAL CONDITION OF THE AFRRI-TRIGA REACTOR
Horace Schow, II Jan. 1966 27 p refs
(AFFRI-TN66-1; AD-635085) CFSTI: HC $2.00/MF $0.50

The numerical evaluation of the theoretical variance/mean ratio of the neutron population in the subcritical condition of the AFRRI-TRIGA reactor is given for (1) the case of no delayed neutron groups; (2) the case of one equivalent delayed neutron group; and (3) the case of six delayed neutron groups. The Courant-Wallace equations were solved to obtain the theoretical variance/mean ratio using the mean prompt neutron lifetime of 39×10^{-6} seconds in the AFRRI-TRIGA reactor.
Author (TAB)

N66-34707# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
IONIC DIFFUSION IN HIGH TEMPERATURE URANIUM DIOXIDE
J. L. Bates 1 Jul. 1965 24 p refs Presented at Intern. Atomic Energy Agency Symp. "Thermodyn. with Emphasis on Nucl. Mater. and Atomic Transport in Solids", Vienna, 22-27 Jul. 1965
(Contract AT(45-1)-1830)
(BNWL-SA-54; Conf-650704-7) CFSTI: HC $1.00/MF $0.50

A review is presented of recent high-temperature property measurements of UO_2 made both in- and out-of-reactor that pertain to atomic movement. The measurements of electrical conductivity, thermoelectric emf, solid state fission fragment migration, and U-O phase equilibria suggest that ionic diffusion in an electrical potential gradient is significant in the movement of fission products and oxygen in UO_2. NSA

N66-34737# Commissariat a l'Energie Atomique, Cadarche (France). Section d'Electronique et d'Instrumentation.

APPLICATION OF STATISTICAL METHODS TO THE TESTING OF NUCLEAR COUNTING ASSEMBLIES [APPLICATION DE METHODES STATISTIQUES A L'ESSAI DES ENSEMBLES DE COMPTAGE NUCLEAIRE]

Jean-Pierre Gilbert and Georges Friedling Apr. 1965 40 p refs In FRENCH

(CEA-R-2725)

The application of the hypothesis test theory to the control of the statistical purity and of the stability of the counting batteries used for measurements on activation detectors in research reactors is described. The principles involved and the experimental results obtained at Cadarache on batteries operating with the reactors PEGGY and AZUR are given.

Author (NSA)

N66-34881# Naval Civil Engineering Lab., Port Hueneme, Calif.

POTENTIAL APPLICATIONS OF RADIOISOTOPES IN THE NAVY Final Report, Feb. 1963-Jun. 1965

L. B. Gardner, A. E. Hanna, and H. E. Stanton May 1966 27 p refs

(R-445; AD-633785) CFSTI: HC $2.00/MF $0.50

The Naval Civil Engineering Laboratory has conducted a study of the potential applications of isotopic devices and techniques within the Naval Shore Establishment. Radiation characteristics, general applications of isotopic devices, and specific problem areas are discussed. Recommendations are included for the use of surface density and moisture gages in the inspection of compacted earth, and for additional work in the determination of the thickness of in-place steel sheet piling and the thickness and density of concrete.

Author (TAB)

N66-34964# Columbia Univ., New York. Plasma Lab.

CRITICAL MASS CALCULATIONS FOR COAXIAL AND VORTEX FLOW GASEOUS CORE REACTORS

Gunter W. Tumm Apr. 1966 98 p refs /*Its* Rept.-26

(Contracts AF 49(638)-1254; AF 49(638)-1634)

(AFOSR-66-1176; AD-635160) CFSTI: HC $3.00/MF $0.75

Design point critical masses are calculated for two configurations of a gaseous core reactor. A new set of resonance and thermal cross sections, developed for this purpose, was used. The following effects and their influence on the critical mass are investigated: the relative position of the fuel region; the presence of hydrogen within the reactor cavity; the reactor operating temperature; the length-to-diameter ratio of the reactor; the presence of a nozzle; a simplified fuel density distribution; and the pressure vessel. For an optimum reactor geometry (corresponding to minimum critical mass) the critical mass of a 'vortex flow' gaseous core reactor is five times smaller than the critical mass of the 'coaxial flow' reactor.

Author (TAB)

N66-35030# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seisbersdorf (Austria). Reaktorzentrum.

FABRICATION METHODS AND EVALUATION OF URANIUM-THORIUM-CARBIDE FUEL FOR HIGH TEMPERATURE GAS COOLED REACTORS

P. Koss and H. Bildstein 1966 34 p refs Presented at 2d Intern. Thorium Fuel Cycle Symp., Gatlinburg, Tenn., 3-5 May 1966

(M-5/1966; SGAE-CH-35/1966) CFSTI: HC $2.00/MF $0.50

Two methods, based on the liquid phase processing, are developed for the fabrication of uranium-thorium-carbide fuels which can be used in high temperature gas-cooled reactors. The first used uranium and thorium in powder form suspended on a paraffin melt, which is sprayed through a nozzle into a cold bath. The second, using synthetic resin components as stabilizers, also involves solutions which are formed into droplets by spraying through a nozzle. Details of both the parrafin and resin processes are given, and the coating of particles is detailed. Attention is given to the determination of surface contamination, thermal chlorination to determine the amount of broken particles, the head end of reprocessing, breakdown of fuel elements, and dissolution of heavy metals.

M.W.R.

N66-35044# Osterreichische Studiengesellschaft für Atomenergie G. m.b.H., Seibersdorf (Austria). Institut fuer Chemie.

INVESTIGATION OF THE FISSION PRODUCT DISTRIBUTION IN THE COATING OF FUEL PARTICLES FOR HIGH TEMPERATURE REACTORS [UNTERSUCHUNG UEBER DIE SPALTRODUKTVERTEILUNG IN DER BESCHICHTUNG VON BRENNSTOFFTEILCHEN FUER HOCHTEMPERATURREAKTOREN]

L. Szterk (Inst. for Atomic Res., Warsaw) and H. Bildstein May 1966 23 p refs In GERMAN; ENGLISH summary Submitted for Publication

(SGAE-CH-33/1966) CFSTI: HC $2.00/MF $0.50

A method has been developed for the determination of fission product distribution in the coating of fuel particles for high temperature reactors, which permits a selective, stepwise dissolution of the various coating layers. By gamma spectrometry of the etching solutions fission product profiles can be determined. The basic development was followed by the application of the procedure on the investigation of two types of coated particles of PyC/SiC/PyC-coatings, irradiated to 16% fifa at a temperature of 1400°C max. As the cooling times of the samples were more than 1 1/2 years distribution could be determined only for longlived nuclides (Zr, Ru, Cs and Ce).

Author

N66-35211*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF THE TRANSIENT FLOW OF HYDROGEN IN HEATED PASSAGES IN THE LAMINAR-TURBULENT TRANSITION REGION

Robert W. Leko Washington, NASA, Sep. 1966 24 p refs

(NASA-TN-D-3629) CFSTI: HC $1.00/MF $0.50 CSCL 21F

A transient analysis was made of the flow characteristics in a single heated tube of circular cross section, and was made in association with phenomena occurring in the nuclear rocket reactor core. Twelve perturbations of heat flux into the tube wall, five perturbations in inlet pressure, and four perturbations of pressure drop were considered. The results are depicted in terms of the phase plane that generalizes the results and illustrates all flow behavior of the laminar instability condition. The external parameters considered, which influence the transient behavior of the system, were inlet pressure, outlet pressure, inlet enthalpy, and heat flux into the tube wall. Five kinds of transients were found. The first corresponds to an initial laminar flow rate on the steady-state curve which when perturbed goes to a turbulent equilibrium point. The second starts from the laminar flow rate on the steady-state curves and terminates at zero flow rate. A third begins from an operating point corresponding to a turbulent flow rate on the steady-state curve and proceeds to an equilibrium point at a higher turbulent flow rate. The fourth is initiated from a turbulent point on the steady-state curves and reaches a stable equilibrium point at a lower turbulent flow rate. The last begins at a turbulent steady-state point and terminates at zero flow. The "stability criterion" near equilibrium points is simply that the four external parameters give an operating point with a positive pressure drop as a function of flow rate slope on the characteristic curves. If this slope is negative or if there is no operating point, then the condition is unstable.

Author

N66-35219*# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.

IRRADIATION OF REFRACTORY FUEL COMPOUNDS, UO_2 AND UC, AT HIGH SPECIFIC POWER TO HIGH BURNUPS—POST-IRRADIATION EXAMINATION OF CAPSULE I

Richard E. Schrieber 1 Aug. 1966 118 p refs

(Contract NAS3-3392)

(NASA-CR-72019; WCAP-2972) CFSTI: HC $3.00/MF $1.00 CSCL 18J

The first of thirteen capsules, each containing four fuel pins, has been irradiated and examined. Three of the pins are UO_2 and the fourth is UC. Mean power levels of 33 kw/ft and burnup of 2.26×10^{20} fission/cc were achieved in each of the 0.3000 inch diameter, 4.0 inch long fuel pellet columns. The AISI 348 stainless steel clad was 10, 20, or 30 mils thick on the UO_2 pins and 20 mils on the UC. All pins were gas bonded, surrounded by NaK, and operated at approximately 760°C fuel surface temperature. Fission gas release, density changes, melting behavior and dimensional changes agreed well with predictions. The 20 mil clad UO_2 pin failed, evidently by local NaK deprivation. Author

N66-35222*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

TUNGSTEN NUCLEAR ROCKET, PHASE II, PART I Final Report, Jan. 16–Jun. 15, 1966

R. G. Bardes, C. F. Bohren, S. C. Cohen, and J. C. Peak 15 Jun. 1966 101 p refs

(Contract SNPC-27)

(NASA-CR-54986; GA-7190) CFSTI: HC $3.00/MF $0.75 CSCL 21F

This report describes further critical experiments and nuclear analyses being performed as part of a feasibility study of the Tungsten Water-Moderated Nuclear Rocket Reactor. The critical facility and the critical assemblies are described. Additional tungsten was added to the two cores for power zoning to flatten the radial power and tailor the axial power profile. Experimental results include the excess reactivity available in the cores, the worth of poison tubes of different cadmium concentration at various radial locations, the isothermal temperature coefficient of the assemblies, power distributions throughout the cores, and pulsed neutron measurements. The experimental results are compared with analysis. Nuclear analysis of the assemblies required careful treatment of the heterogeneous nature of the core. Detailed analyses which accounted for the two-dimensional cell structure, resonance overlap, and TNO-region resonance effects were compared with experimental results; good agreement was found for both water- and beryllium-reflected assemblies, zoned and unzoned assemblies, and assemblies with and without cadmium poison. Author

N66-35248# Los Alamos Scientific Lab., N. Mex.

PROCEEDINGS OF AN ADVANCED NUCLEAR PROPULSION SYMPOSIUM

Ralph S. Cooper, comp. 1 Jun. 1965 371 p refs Symp. held Apr. 1964

(Contract W-7405-ENG-36)

(LA-3229-ms; CONF-640410) CFSTI: HC $7.00/MF $1.50

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N66-35256# Japan Atomic Energy Research Inst., Tokyo. Integral Transport Codes Development Group.

EPSILON—AN IBM-7090 CODE FOR COMPUTING FAST FISSION EFFECTS IN LATTICE BY COLLISION PROBABILITY METHOD

Ichiro Kumatsu and Yuzo Fukai Mar. 1966 26 p refs

(JAERI-1105)

The fat fission effects in the multi-region lattices of cylindrical rods and slabs are calculated, using the collision probability method for the spatial problem and the multigroup technique. The content of the EPSILON code for calculation of the fast fission effects by the IBM-7090 is described. The EPSILON code has a maximum number of 5 regions in the lattices, including a maximum number of 2 fuel regions, a maximum number of 100 energy groups, and a maximum number of 10 elements in one region. The computing time is about 3 minutes when the number of energy groups is 18, the region number is 5 and the element number in the cylindrical rod lattice is 10. The calculation method for the fast fission effects is first given, then, the collision probabilities used in the EPSILON code are discussed, and the

content of the code is last described. In an appendix, the EPSILON–LT code for making a library tape of the EPSILON is described. Author (NSA)

N66-36281# European Atomic Energy Community, Brussels (Belgium).

FINE STRUCTURE OF THE THERMAL FLUX AND END-EFFECT IN TUBULAR COMPOSITE URANIUM FUEL ELEMENTS COOLED BY AN ORGANIC COMPOUND [STRUCTURE FINE DU FLUX THERMIQUE ET EFFET DE BOUT DANS DES ELEMENTS COMBUSTIBLES TUBULAIRES D'URANIUM METALLIQUE RE REFROIDIS PAR UN PRODUIT ORGANIQUE]

A. Boeuf and S. Tassan Jun. 1966 27 p refs In FRENCH; ENGLISH summary

(EUR-2981-f) CFSTI: HC $2.00/MF $0.50

The report describes the measurement of the fine structure of the thermal flux in a composite fuel element consisting of two concentric annuli of natural uranium, cooled by an organic compound and moderated by heavy water; and of the flux peaking at the junction of two elements of this type. The measurement has been performed by the activation technique, using dysprosium detectors. Author

N66-36283# European Atomic Energy Community, Brussels (Belgium).

THE THORIUM ORGEL TYPE REACTOR

F. Lafontaine, B. Havtink, and J. Noeilly Jun. 1966 24 p refs (EUR-2995-e) CFSTI: HC $1.00/MF $0.50

The performances of an ORGEL reactor burning thorium fuels are given. In calculating them, the features of the ORGEL concept have been maintained and no research and development on new materials have been undertaken. The performances are compared with those of an ORGEL reactor burning natural or slightly enriched uranium. It seems that the ORGEL thorium type reactor presents some economic advantages only in the case of U^{233} recycling and big power unit size (1000 MWe). However, one must keep in mind that the uranium type reactor is ready to be made on industrial scale and it is not the case for the thorium type. Author

N66-36294# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Physics Div.

USE OF Ge(Li) DETECTORS IN γ–γ COINCIDENCE EXPERIMENTS

G. T. Ewan, R. L. Graham, and I. K. Mac Kenzie Mar. 1966 15 p refs Presented at the 10th Scintillation and Semicond. Symp., Washington, 2–4 Mar. 1966 Submitted for Publication

(AECL-2565; CRGP-1237) CFSTI: HC $1.00/MF $0.50

Large volume Ge(Li) detectors have been used in a γ–γ coincidence arrangement employing two Ge(Li) detectors. The first part of this paper reports the results of studies of the timing properties of planar and coaxial diodes and the time resolution curves that can be obtained. For two cylindrical coaxial diodes the full-width at half-maximum of the time resolution curve was 14 nsec for 511 keV γ-rays. The second part of the paper describes the application of the detectors in γ–γ coincidence experiments. The coincidence counting rates are limited by the total singles counting rates that can be tolerated without excessive loss of energy resolution. Results are shown illustrating the application of a Ge(Li)–Ge(Li) coincidence arrangement to a complex γ-ray spectrum and the ability of this technique to reveal new information on γ–γ cascades. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-34152# Houston Univ., Tex. Dept. of Electrical Engineering.

SCATTERING FROM A SINUSOIDALLY PERIODIC SURFACE IN MOTION

Y. J. Seto and H. S. Hayre [1965] 8 p refs

(Contract Nonr-4492(02))

(AD-633616) CFSTI: HC $1.00/MF $0.50

This work shows that in addition to doppler effect, there is considerably stronger polarization dependence of the scattered field by a moving sinusoidal surface as opposed to the stationary case. For the case of acoustic waves, a slowly moving surface contributes insignificantly to the amplitude to the reflection coefficient, but may appreciably affect its angular dependence. Author (TAB)

N66-34183# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Electrophysics Dept.

MODAL ANALYSIS AND SYNTHESIS OF ELECTROMAGNETIC FIELDS Interim Scientific Research Report

Leopold B. Felsen and Nathan Marcuvitz 29 Dec. 1965 81 p refs

(Contract AF 19(628)-4324)

(PIBMRI-1307-65; AFCRL-66-176; AD-634185) CFSTI: HC $3.00/MF $0.75

Electromagnetic radiation and diffraction problems in regions characterized simply in a spherical coordinate system are analyzed from a spherical transmission line viewpoint. The electromagnetic fields are decomposed into E mode and H mode constituents with respect to the radial coordinate, and these separate contribution may in turn be derived from scalar potentials functions, which satisfy the scalar wave equation. Alternative representations for the potentials in terms of transmission along the angular coordinates are presented and their respective virtues discussed. The results are applied to various electromagnetic boundary value problems involving spherical, conical, and wedge-shaped obstacles, and high-frequency asymptotic solutions are derived which permit an interpretation of the field in quasi-optical terms. Author (TAB)

N66-34289# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

HEREDITARY DEPENDENCE IN DYNAMICS

G. Stephen Jones Mar. 1966 33 p refs

(Contract Nonr-595(17); Grant NSF GP-3666)

(BN-442; AD-633627) CFSTI: HC $2.00/MF $0.50

An extended definition of lag functions that allows dependence of hereditary sets on the state of the system is given. The notion of lag function is employed in order to give a unified formulation to differential-difference equations that were previously used. By means of an existence theorem it is demonstrated that the unification does beyond formulation of functional form, and it is demonstrated that it is possible to establish an existence theory similar in form to ordinary differential equations. The initial data problem and the hereditary structure for the equations are explained. Translation classes are used to introduce reasonable topology on function space elements. Without restricting himself to proper lag functions, the author concludes that all specific formulations involving hereditary dependence which were discussed may be characterized by proper lag function. K.W.

N66-34324*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MAGNETIC FIELD OUTSIDE PERFECT RECTANGULAR CONDUCTORS

Lawrence Flax and Joseph H. Simmons Washington, NASA, Aug. 1966 21 p refs
(129-02-05-02-22)
(NASA-TN-D-3572) CFSTI: HC $1.00/MF $0.50 CSCL 22C

Explicit solutions are obtained in parametric form for the magnetic field due to surface currents flowing on an infinitely long rectangular conductor. The well-known analogy between the two-dimensional magnetic potential problem and the corresponding electrostatic problem is exploited to obtain these solutions. The method employed is a previously developed Schwartz–Christoffel transformation that maps the complex space outside a rectangle into the complex space outside a unit circle. Explicit solutions for the magnetic field outside the rectangle are derived. Author

N66-34346*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

GROUND TESTING AT MSFC

1965 48 p refs *Its* Res. Achievements Rev., Ser. No. 9
(NASA-TM-X-53486) CFSTI: HC $2.00/MF $0.50 CSCL 20A

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1. ANALYSIS OF EMPIRICAL SOUND FIELDS G. H. R. Reisig p 1–14 refs (See N66-34347 20-23)
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N66-34347*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ANALYSIS OF EMPIRICAL SOUND FIELDS

Gerhard H. R. Reisig *In its* Ground Testing at MSFC 1965 p 1–14 refs (See N66-34346 20-23) CFSTI: HC $2.00/MF $0.50

The large-scale field collection of acoustic data and their analysis are described. The entire sound-field program has the purpose of solving complex problems of excessive noise propagation associated with the static test firing of large space-booster powerplants. The statistical evaluation of sound-measurement data shows that the polar distribution of sound in the springtime is determined mainly by the temperature field of the atmosphere. The data on sound attenuation as a function of distance from its source revealed attenuation in excess of the expected magnitude. Statistical analysis of sound-intensity extremes indicated amplification of the sound signals by focusing which could be expected along selected azimuths. Empirical amplification values showed the maximum occurring in winter (50 decibels at 22 kilometers). Author

N66-34349*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOUND SUPPRESSION TECHNOLOGY RESEARCH AT MARSHALL SPACE FLIGHT CENTER

Fritz Kramer *In its* Ground Testing at MSFC 1965 p 29–36 ref (See N66-34346 20-23) CFSTI: HC $2.00/MF $0.50

This report describes some of the development tests conducted on sound suppressor models. These devices are designed to reduce the sound radiated into the atmosphere from the exhaust jets of large rocket engines. From theoretical considerations, the overall sound reduction capability of the tested models was expected to amount to 40 decibels. However, residual sound, radiated from the rocket engine and its installation, limited the attainable overall suppression to 24 decibels. Suppression of very low sound frequencies remains a special area of endeavor in future investigations. The models were designed to be self-contained. They proved to possess very good operational characteristics. Author

N66-34350# New York Univ., N. Y. Magneto-Fluid Dynamics Div.

HIGH FREQUENCY SOUND ACCORDING TO THE BOLTZMANN EQUATION

Harold Grad 15 Feb. 1966 47 p refs Presented at the SIAM Meeting in Honor of Richard Courant, New York Univ., New York, 8 Jun. 1965 Submitted for Publication
(Grants AF-AFOSR-815-66; NSF GP-4960)
(MF-49; AFOSR-66-0145; AD-633979) CFSTI: HC $2.00/MF $0.50

The boundary value problem of sound generated at an oscillating wall propagating into a half space is solved for a linear Boltzmann equation with a general cutoff intermolecular potential and an arbitrary boundary condition at the wall. For a small bounded domain (two walls closer than a mean free path) proof of the existence of a solution is relatively simple. In a half space the solution is proved to exist for sufficiently high frequency $\omega > \omega_0$ (ω_0 is comparable to the mean collision frequency), asymptotic expressions show the disappearance of a conventional sound wave at high frequency. This is consistent with known results for a relaxation model of the Boltzmann equation and qualitative estimates for the actual Boltzmann equation based on the dominance of the continuous spectrum at high frequency. At a fixed arbitrary distance from the wall, the dominant high frequency disturbance consists of just those particles emitted by the wall, decreased by scattering, but without any compensating contribution from the creation term of the collision operator. Author (TAB)

N66-34370*# Perkin–Elmer Corp., Norwalk, Conn. Electro-Optical Div.

PRINCETON ADVANCED SATELLITE STUDY. VOLUME II: GENERAL PROBLEMS ASSOCIATED WITH SPACEBORNE TELESCOPES

In its Princeton Advanced Satellite Study [1966] 87 p refs (See N66-34368 20-31) CFSTI: HC $6.22/MF $2.75
(Rept.-8346(II))

Various mirror materials and configurations were compared for their resistance to elastic strain during testing, elastic and plastic strain during launch, and thermal strain and long-term dimensional stability during operation. Silicon evolved as a 6 times better material than aluminum and beryllium, and an order of magnitude better than fused silica depending on the operating temperature. Possible ribbed mirror configurations, composite mirror structures, and an active optical telescope system from an array of smaller mirrors were briefly discussed together with aluminum based reflected coatings for application in the UV spectral region and the effects of temporal variation in heat flux on the telescope components were used to depict critical design areas. A detailed theoretical study proved the feasibility of achieving pointing accuracy by defining stellar magnitude, aperture diameter, and system bandwidth. Design concepts were also developed for accurate tracking and acquisition methods. G.G.

N66-34478# Naval Applied Science Lab., Brooklyn, N. Y.

ACOUSTIC IMPEDANCE TUBE FOR STUDY OF ANECHOIC COATINGS

D. H. Kallas 1 Jun. 1966 7 p refs
(PR-1; AD-634202) CFSTI: HC $1.00/MF $0.50

A mathematical study was made related to theory and design of acoustic impedance tubes. These devices, based on the propagation of sound waves in water, are commonly used for

the study of acoustic properties of materials. The study was preliminary to design and construction of an impedance tube for use in a sonar materials program at NASL. The report consists of a descriptive summary of the developed mathematical analysis. The complete analysis is contained in AD-634 203.
Author (TAB)

N66-34519# Picatinny Arsenal, Dover, N. J. Mathematical Analysis Div.
TRAJECTORY EQUATIONS FOR A SIX-DEGREE-OF-FREEDOM MISSILE USING A FIXED-PLANE COORDINATE SYSTEM
B. Barnett Jun. 1966 80 p refs
(PA-TR-3391; AD-634267) CFSTI: HC $3.00/MF $0.75

This report derives from elementary principles the general equations of motion for a missile utilizing a fixed-plane coordinate system, i.e., a coordinate system with one axis constrained to lie in a given plane. Included in the derivation are explicit expressions for introducing wind and an alternate set of equations to be used when singularity conditions are approached. Means are provided for automatically converting to the alternate set of equations so that uninterrupted trajectory simulation can proceed under all conditions. A complete discussion of initial conditions is included. The general equations can be used for flat or spherical, rotating, or nonrotating earth cases. Author (TAB)

N66-34526# RAND Corp., Santa Monica, Calif.
THE NULL BUNDLE OF AN EINSTEIN-RIEMANN SPACE III: EXTENSION
Dominic G. B. Edelen Jun. 1966 45 p refs
(Contract AF 49(638)-1700)
(RM-4873-PR; AD-634257) CFSTI: HC $2.00/MF $0.50

The memorandum obtains extensions of the previous results and applies them to a larger class of spaces described by the Einstein field equations of general relativity. The result is a system of partial differential equations involving only scalar unknowns and having certain important homogeneity properties. These properties allow the researcher to obtain a number of new solutions of the field equations that aid in understanding the implications of gravitational fields. Author (TAB)

N66-34527# Naval Radiological Defense Lab., San Francisco, Calif.
NRDL 70-INCH CYCLOTRON EXTERNAL ION OPTICS SYSTEM
Daniel J. Horen 15 Apr. 1966 14 p refs
(USNRDL-TR-1008; AD-634300) CFSTI: HC $1.00/MF $0.50

The initial external ion-optics system for the 70-in. cyclotron is presented. Initially, four experimental target areas will be developed. The magnetic components consist of a homogeneous-field circular switching magnet, an inhomogeneous field analyzing magnet and two element quadrupole magnets. Focussed or defocussed, unanalyzed beams will be available for biomedical research and irradiations of nuclear chemistry targets. An unanalyzed but focussed beam will be provided for irradiating neutron producing targets for neutron shielding studies, and an analyzed beam for nuclear reaction studies. Author (TAB)

N66-34621# Naval Ordnance Test Station, China Lake, Calif.
MOTION OF A SPINNING BODY EQUIPPED WITH A DYNAMIC DAMPER CONTAINING VISCOUS FRICTION
Prescott D. Crout Jun. 1966 42 p refs
(NAVWEPS-8715; NOTS-TP-3761; AD-635124) CFSTI: HC $2.00/MF $0.50

The effect of a linear dynamic damper with viscous friction on the motion of a spinning body having an axis of dynamic symmetry is determined. Expressions for the natural frequencies and the time constants of the system are obtained, after which the motion of the system due to a unit torque impulse normal to the axis of symmetry is determined. Finally, the motion due to any given torque-time relationship is determined. Author (TAB)

N66-34639*# AVCO–Everett Research Lab., Everett, Mass.
EXPERIMENTAL INVESTIGATION OF ADVANCED SUPERCONDUCTING MAGNETS Annual Report
Ethan Hoag Jul. 1966 87 p refs
(Contract NAS8-5279)
(NASA-CR-77307) CFSTI: HC $3.00/MF $0.75 CSCL 20C

Details are given from research on two dimensional effects in composite conductors; current distribution in a superconducting Nb-Zr strip; the operation of superconductors at temperatures below the lambda point; boiling heat transfer to liquid helium in vertical passages; a comparative analysis of superconducting magnet energizing systems; and the operation of an experimental transformer energizer. H.S.W.

N66-34685*# Texas Western Coll., El Paso. Schellenger Research Labs.
GROUND SUPPORT, DATA ANALYSIS AND ASSOCIATED RESEARCH AND DEVELOPMENT FOR THE ROCKET GRENADE EXPERIMENT Final Report, 16 Aug. 1961–31 May 1965
J. Frank Casey Jun. 1965 197 p refs
(Contract NAS5-2949)
(NASA-CR-77235) CFSTI: HC $5.00/MF $1.25 CSCL 20A

Field support activities are outlined for the sound ranging arrays located at Wallops Station Main Base, Fort Churchill, Ascension Island, Wallops Assateague, and Point Barrow. The development of equipment for measuring the noise level on the hot wire microphone is discussed, along with the research conducted on wind noise problems and noise reduction devices. A capacitor microphone was used to identify the wave shape of the grenade arrivals as N waves, and an analysis was made to determine the harmonic content of the waves. Data analyses methods and procedures are reviewed, and flow charts of the four separate programs used in the computations are included. Figures show the relative positioning of microphones and instrumentation location, together with the actual array coordinates used in the computer program. Efforts to improve the performance of a tube designed to measure sound absorption in gases are discussed, with details given on the modifications carried out to provide temperature control. M.G.J.

N66-34691# Royal Aircraft Establishment, Farnborough (England).
ELECTRICAL BREAKDOWN IN INSULATING FLUIDS [DER DURCHSCHLAG DER ISOLIERENDEN FLUESSIGKEIT]
Alexander Nikuradse May 1966 23 p refs Transl. into ENGLISH from Elektrotech. Maschinenbau (Berlin), v. 50, no. 34, 1932 p 465–470
(RAE-LIB-TRANS-1166) CFSTI: HC $1.00/MF $0.50

The influence of the various parameters (pressure, temperature, purity, frequency, electrode shape, etc.) upon breakdown potential in insulating fluids is discussed. The familiar hypotheses concerning electrical breakdown are briefly surveyed. Author

N66-34783# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THEORY OF A CIRCULAR DIELECTRIC RESONATOR
A. M. Goncharenko and B. A. Sotskii 20 May 1966 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR, v. 8, no. 6, 1965 p 360–363
(Contract NOw-62-0604-c)
(TG-230-T475; AD-634246) CFSTI: HC $1.00/MF $0.50

The behavior of a circular dielectric resonator under certain critical operating conditions is discussed. The general expressions for the performance and energy losses of a finite circular resonator which were derived in part I (AD-634 248) of the article are applied to this case. It is concluded that only lower axial oscillations may occur at threshold pumping levels. At higher pumping levels nonaxial modes may also occur, resulting in a broadening of the beam. Author (TAB)

N66-34822# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.

AN IMAGE-SUPERPOSITION TECHNIQUE FOR MEASURING TIME BETWEEN ULTRASONIC ECHOES

Anthony G. Martin May 1966 17 p refs

(AMRA-TR-66-18; AD-635530) CFSTI: HC $1.00/MF $0.50

An image-superposition technique has been developed for accurately measuring the time interval between two ultrasonic echoes. The measurement is made by alternately shifting displayed images of the echoes so that the images are superposed. The amount of shifting is controlled by digital circuitry in such a way that the time interval is the inverse of the frequency of a recurrent square wave. This frequency is measured very accurately by a frequency counter. The accuracy of the final results is limited mainly by the properties of the specimen and ultrasonic apparatus, and by the characteristics of ultrasonic pulses. Including the effects of these factors, measurements are accurate to within a few tenths of a percent. Author (TAB)

N66-34879# Brown Univ., Providence, R. I.

ON THE SYMMETRY GROUPS OF SIMPLE MATERIALS—AN APPLICATION OF THE THEORY OF LIE GROUPS

Takayuki Nono Apr. 1966 12 p refs

(Contract Nonr-562(40))

(TR-11; AD-633778) CFSTI: HC $1.00/MF $0.50

The main purpose of this paper is to point out that the symmetry group of a simple material is a Lie subgroup of the unimodular group. The classification of symmetry groups and the determination of representation formulae for objective response functions can be established by the application of the theory of Lie groups. Author (TAB)

N66-34922# Washington Univ., Seattle. Dept. of Electrical Engineering.

SECOND ORDER MOMENTS IN RADIATIVE SYSTEMS Technical Report No. 104

J. N. Lahti and Akira Ishimaru Mar. 1966 63 p refs

(Contract AF 19(628)-2763)

(AFCRL-66-248; AD-635184) CFSTI: HC $6.00/MF $0.75

The radiative system (the source and its radiation field) is described as a continuous parameter stochastic process. A mathematical model is introduced which avoids a number of difficulties encountered in existing formulations of second order coherence theory. Equations obeyed by the coherence tensors in the radiation field are obtained in a simplified manner and general solutions to the tensor equations are found. Special cases and approximate forms (analogous to the Fresnel and Fraunhofer approximations) of the general solutions are presented. Author (TAB)

N66-34976# Institute of Modern Languages, Inc., Washington, D. C.

CORRELATION BETWEEN THE CONDUCTIVITY AND THE EMISSION CHARACTERISTICS OF CESIUM OXIDE CATHODES

P. Borziak Ft. Belvoir, Va., Army Engr. Res. and Develop. Labs., May 1966 18 p Transl. into ENGLISH from Zh. Tekh. Fiz. (Leningrad), v. 9, no. 22, 1939 p 2032–2041

(Contract DA-44-009-AMC-1563(T))

(T-1840-66; TT-66-61376; AD-633411) CFSTI: HC $1.00/MF $0.50

An investigation was made of the emission properties of a complex cesium oxide cathode in connection with the electrical conductivity of the films of this cathode. Author (TAB)

N66-35008# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

THE USE OF A SIMPLIFIED NEUTRON ACTIVATION TECHNIQUE FOR ANALYZING METALLIC WEAR FROM AIRCRAFT HYDRAULIC SYSTEMS

M. D. D'Agostino and F. J. Kuehne Jun. 1966 47 p refs Presented at the First Symp. on Radioisotope Appl. in Aerospace, Dayton, Ohio, 15–17 Feb. 1966

(Contract NOw-63-0708-c)

(RE-254J; AD-483535)

A simplified, inexpensive means of using neutron activation analysis to detect metallic deterioration products filtered out of hydraulic systems has been developed. The simplification of established activation analysis techniques was made possible by reducing the analysis of complex gamma ray spectra (resulting from the activation of a mixture of several elements) to a simple procedure, and by the availability of small, inexpensive neutron generators (producing 14.5 MeV neutrons) and multi-channel analyzers. Authro (TAB)

N66-35043# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

THE SEMINAR AT THE PHYSICS LABORATORY DURING THE PERIOD JANUARY–APRIL 1966 [IL SEMINARIO DEI LABORATORI DI FISICA NEL QUADRIMESTRE GENNAIO-APRILE 1966]

W. F. Libby et al 4 May 1966 86 p refs in ITALIAN and ENGLISH

(ISS-66/19) CFSTI: HC $3.00/MF $0.75

Summaries are presented of lectures given at the Physics Laboratory of the Istituto Superiore di Sanita. Methods, apparatus, and experimental results are given for researches dealing with space chemistry, electron scattering, paramagnetic resonance, particle absorption and diffusion, and laser beams; as well as spontaneous mutations, induced chromosomal breaks, and polyribosomes. The interpretation and experimental verification of the general theory of relativity is also covered. M.W.R.

N66-35062# Navy Underwater Sound Lab., New London, Conn.

EQUATIONS OF MOTION FOR A TOWED BODY MOVING IN A VERTICAL PLANE

Kirk T. Patton and Jeffrey W. Schram 15 Jun. 1966 42 p refs

(USL-736; AD-635214) CFSTI: HC $1.50/MF $0.50

Equations of motion are developed for a towed body moving in a plane defined by gravity and the fore-and-aft axis of the ship. Solution of the cross-coupled equations enables predictions to be made of towed body heave, surge, and pitch motions. The towline is approximated as a spring with one third of its mass added to the body at the towpoint. A discussion of computational techniques to compute masses, damping constants, and spring constants is also presented. Because of the number of terms in the equations for heave, surge, and pitch, the solutions have been programmed in Fortran IV. Author (TAB)

N66-35094# Brown Univ., Providence, R. I. Div. of Engineering.

WEAKLY-RADIATIVE ACOUSTIC FLOW INDUCED BY RADIATION FROM A STATIONARY WALL

Alexander Solan and Ira M. Cohen Mar. 1966 22 p refs (Contract Nonr-562(35))

(AD-631945) CFSTI: HC $1.00/MF $0.50

The radiative wave flow induced by radiation from a stationary solid wall is treated for large ratio of photon mean free path to molecular mean free path, and large Boltzmann number. The time scale considered is of the order of the photon m.f.p. divided by the speed of sound. Under these conditions the problem is split into radiationless, heat-conducting boundary layer and a radiation-induced acoustic outer region. These are reduced to the form of a heat-conduction equation and an inhomogeneous linear wave equation, respectively, and solved in closed form. The radiation-induced acoustic flow is characterized by a weak discontinuity (in the second derivatives of the flow variables) propagating at the isentropic speed of sound. The result is a simple analytic representation of the long-range character of radiation-induced flow and will be useful as a reference solution for comparison with more complex problems. TAB

N66-35095# Air Force Cambridge Research Labs., Bedford, Mass. Optical Physics Lab.

OZONE ABSORPTION IN THE 9.0 MICRON REGION

Shepard A. Clough and Francis X. Kneizys Nov. 1965 86 p refs *Its* Phys. Sci. Res. Paper No. 170

(AFCRL-65-862; AD-628059) CFSTI: HC $3.00/MF $0.75

The absorption of ozone in the 9.0 micron region of the infrared spectrum, due to transitions from the ground state to the v-1 and v-3 states, was studied. The report gives the numerical results of an analysis of the spectrum including transition frequencies and perturbed intensities ordered by quantum number and by frequency. Calculated and observed spectral contours are included. Author (TAB)

N66-35108# Aeronutronic, Newport Beach, Calif.

ABSORPTION BY H20 BETWEEN 2800 AND 4500 cm-1 (2.7 MICRON REGION)

Darrell E. Burch, David A. Gryvnak, and Richard R. Patty 30 Sep. 1965 129 p refs

(Contract Nonr-3560(00); ARPA Order 273)

(U-3202; AD-626726) CFSTI: HC $4.00/MF $1.00

The absorption by water vapor between 2800 and 4500 cm^{-1} has been investigated. Spectra have been obtained for samples at pressures from 0.48 torr to 10 atm, and with absorber thicknesses varying from 8×10^{-4} to 0.7 gm cm^{-2}. Transmission spectra are shown along with extensive tables of transmittance, integrated absorptance, and the integrated absorption coefficient. Results are presented for samples chosen to provide information about the strengths, widths, and shapes of many of the absorption lines. Author

N66-35135# National Physical Lab., Teddington, (England).

SCHLIEREN METHODS

D. W. Holder and R. J. North London, HMSO, 1963 114 p refs *Its* Notes on Appl. Sci. No. 31

CFSTI: HC $4.00/MF $0.75

The principles of schlieren methods, their physical nature, and the practical problems that arise in their use for aerodynamic research are discussed. Emphasis is placed on changes in the refractive index of air flow densities in wind tunnels and shock tubes. Evaluated are interferometric, schlieren, and direct shadow techniques and their corresponding apparatuses; some methods of supplementing schlieren photographs with tufts, smoke, and oil films placed on the surfaces exposed to a flow, as well as the use of vapor-screens and tuft grids for observing the vortex pattern behind a body are included. Appendixed values can be utilized for the design, set up, and use of suitable apparatuses in particular observations. G.G.

N66-35173*# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Systems Research Section.

STUDY ON DETERMINING STABILITY DOMAINS FOR NONLINEAR DYNAMICAL SYSTEMS Quarterly Progress Report No. 1, 1 May–1 Aug. 1966

G. Geiss 15 Aug. 1966 19 p refs

(Contract NAS8-20306)

(NASA-CR-77429; RM-334) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The procedure for formulating the problem of estimating the domain of attraction of an equilibrium solution of a nonlinear dynamical system as two extremal problems is briefly described. The numerical algorithm used to solve these extremal problems is outlined, and the qualitative aspects of the computational results are described. Some remaining problems are described and the plans for future work are stated. Author

N66-35184*# General Motors Corp., Santa Barbara, Calif. Defense Research Labs.

AZIMUTH AXIS OPTICAL ALIGNMENT SYSTEM Final Report

R. F. Brewster, G. C. Kuipers, W. W. Metheny, and J. N. Siebert 15 Feb. 1966 41 p refs

(Contract NAS8-11649)

(NASA-CR-77524) CFSTI: HC $2.00/MF $0.50 CSCL 20F

An azimuth axis optical alignment system, which can monitor and measure the altitude or angular position of a remote object about the aximuth axis was tested under a variety of weather conditions and at different ranges, up to 1000 ft. A recording of the signal to noise ratio at 1000 ft is given. The repeatibility of null, or accuracy, was found to be within plus or minus one second of arc. The ability of the system to accept translations of the vehicle unit was excellent. Translations of plus or minus 2 1/2 ft did not cause loss of acquisition or errors greater than plus or minus one second of arc. The instantaneous acquisition angle was found to be greater than plus and minus one full degree. The system does not use a geometrical image reflected from a plane mirror as is the case in autocollimators, but employs phase information imposed on the returning beam of light. A retroreflector is used to return the transmitted beam. Details of the electronic subsystem are described, and calculations for the signal to noise ratio are given. L.S.

N66-35185*# Wyle Labs., Inc., El Segundo, Calif.

AERODYNAMIC NOISE RESEARCH SUPPORT Quarterly Progress Report, Apr.–Jun. 1966

M. V. Lowson 30 Jun. 1966 10 p refs

(Contract NAS8-11308)

(NASA-CR-77523) CFSTI: HC $1.00/MF $0.50 CSCL 20A

A theoretical study of shock turbulence interactions was completed which predicts that fluctuating pressure levels over 170 dB could occur due to the interaction of an escape tower wake turbulence with a separation shock. The study also indicates levels of well over 160 dB for the peak fluctuating pressure immediately beneath a typical separation shock. An experimental program to substantiate and extend the theory is recommended. The results will facilitate engineering prediction of significant surface pressure fluctuations in complex supersonic turbulent flows, particularly for the effects of turbulent wake from an escape tower and other protuberances. The mechanisms causing pressure fluctuations beneath shock waves, and the significance of shock wave feedback in panel response problems would be defined by a complete program.

Schematic diagrams of component parts for suggested experimental rigs for investigating shock turbulence and shock-sound interaction, and for investigating shock-panel coupling effects are depicted. L.S.

N66-35186# Centro Brasileiro de Pesquisas Fisicas, Rio de Janerio.

ON THE SOLUTION OF THE ELECTROMAGNETIC EQUATIONS FOR ROTATING SYSTEMS

I. Wolk and R. C. T. da Costa 1965 15 p refs *Its* Notas de Fisica Vol. 12, No. 1

CFSTI: HC $1.00/MF $0.50

The electromagnetic equations relative to a rotating system are introduced with the help of the space-time metric, and their solutions investigated in the case of an electric current flowing parallel to the rotation axis. It was found that in the stationary case the rotation effects manifest themselves through a change in the argument of the Bessel function giving the radial solution; this change is absent for problems with cylindrical symmetry about the axis of rotation. However, in the time-dependent case even the symmetric solutions are modified, the Bessel functions being substituted by hypergeometric functions. The dependence in θ and z (the angular and axial coordinates) of the separated solutions is unaffected in all cases. Author

N66-35187# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.

ON THE INTERACTION OF THE GRAVITATIONAL AND SPINOR FIELDS

Colber G. Oliveiro and Alberto Vidal 1965 19 p refs Sponsored in part by C.L.A.F. *Its* Notas de Fisica Vol. 12, No. 2

CFSTI: HC $1.00/MF $0.50

A simplified version of the interaction problem which uses the Hamiltonian formulation and a conveniently oriented set of tetrads is discussed. The dynamical variables for the interacting system are related by a set of four secondary and three primary constraints. These constraints represent the generators of local Lorentz transformations and of infinitesimal coordinate transformations. The coupled system is studied from the point of view of the three-dimensional geometry and under the condition that the gravitational field is a linear field. The transformation law for the spinor field is then interpreted as a gauge transformation in the three-dimensional hypersurface of constant time. An expression for a gauge invariant quantity involving the spinor field is derived. N.E.N.

N66-35188# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.

ON THE STABILITY OF THE PLANE-WAVE HARTREE-FOCK STATE

A. M. de Graaf and R. Luzzi 1965 14 p refs *Its* Notas de Fisica Vol. 12, No. 3

CFSTI: HC $1.00/MF $0.50

Considering small deviations from the paramagnetic plane-wave Hartree-Fock state, the condition for the stability of that state is derived using Landau's theory of the Fermi liquid. It is shown that this condition is identical with that derived by other many-body techniques. Comparison is made with Overhauser's theory of giant static spin-density waves. Author

N66-35191# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.

NOTE ON THE ROLE PLAYED BY CANONICAL QUANTITIES IN FLUCTUATION THEORY

R. C. T. da Costa 1965 17 p refs *Its* Notas de Fisica Vol. 11, No. 21

CFSTI: HC $1.00/MF $0.50

A physical interpretation for the different terms appearing in the expressions of the second order fluctuations already developed in previous works is found to be possible by considering the system in question in close contact with appropriate surroundings of infinite extension. These surroundings must be such that some of the macroscopic constants of motion of the system remain unchanged, whereas the other ones (called canonical) are allowed to fluctuate freely around their former constant values. Other properties of the canonical quantities related to fluctuation theory are also considered. Author

N66-35205*# Linear, Inc., Evanston, Ill.

LINEAR SOLAR MODULE: REFINEMENT, MEASUREMENT, AND EVALUATION OF OPTICS Final Report

J. Robert Gettel, Garry F. Comiskey, and Richard A. Karlin Aug. 1965 226 p refs

(Contract NAS3-2794)

(NASA-CR-54479) CFSTI: HC $3.75/MF $1.25 CSCL 20F

The optical portion of a solar module was refined, adapted, prototyped, and evaluated. The ultimate objective is a modular-type solar simulator capable of operation within a space environment facility. The module uses a mercury-xenon or xenon short-arc source in an on-axis system consisting of segmented reflectors, one or two lenticular plates, and baffles. The performance of the prototype optical system clearly indicates that efficiencies of 25 to 30 per cent can be achieved within a 15 inch module diameter using a 2500 watt source. The advisability of a wider angular distribution specification is indicated. The ability to meet a much tighter uniformity specification is shown. Excellent spectral uniformity, due to an almost complete absence of chromatic aberration plus spectral integration by the lenticular plates is demonstrated. Revised specifications are discussed. Author

N66-35228*# ITT Industrial Labs., Fort Wayne, Ind.

A DAY-NIGHT HIGH RESOLUTION INFRARED RADIOMETER EMPLOYING TWO-STAGE RADIANT COOLING, VOLUME I First Quarterly Report, 1 Jan.-1 Apr. 1966

12 May 1966 92 p refs

(Contract NAS5-10113)

(NASA-CR-77542; ITTIL-66-1029) CFSTI: HC $3.00/MF $0.75 CSCL 20F

The design of a two-stage radiant cooler to be used in cooling an infrared detector in a 10 to 12.2 micron day-night high resolution infrared radiometer is described. The cooler is to be used on a Nimbus-type spacecraft, in circular orbit at 750 nautical miles altitude. Details on the cooler and component design, environmental testing and test equipment, and an analysis of the thermal performance are given. It was concluded that a radiant cooler can be designed and constructed to attain a temperature below 80°K in the second stage when operated on the spacecraft, and in addition, that it is possible to simulate in-orbit thermal conditions during space chamber testing. It is pointed out that the value of emissivity of the gold coating on the first-stage cone must be determined before the final design is set. Appendices on technical calculations are contained in Vol. II. N.E.N.

N66-35229*# ITT Industrial Labs., Fort Wayne, Ind.

A DAY-NIGHT HIGH RESOLUTION INFRARED RADIOMETER EMPLOYING TWO-STAGE RADIANT COOLING, VOLUME II First Quarterly Report, 1 Jan.-1 Apr. 1966

[1966] 58 p refs For abstract see N66-35228 20-23

(Contract NAS5-10113)

(NASA-CR-77541) CFSTI: HC $3.00/MF $0.75 CSCL 20F

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-34155# Illinois Univ., Urbana. Dept. of Physics.
A $\Sigma\pi\pi$ MASS ENHANCEMENT AND A NEARBY TRIANGLE SINGULARITY
Melvin Month [1965] 16 p refs
(Contract Nonr-1834(05))
(AD-634340) CFSTI: HC $1.00/MF $0.50

The enhancement observed in the $(\Sigma\pi\pi)^+$ system at about 1660 MeV is described using a triangle diagram which has an intermediate state composed of a π^+ and a $Y_0^*(1520)$. In view of this, it is suggested that this enhancement does not represent the three particle decay mode of the $Y_1^*(1660)$, but that rather it is the result of a final state interaction mechanism. Author (TAB)

N66-34172# Illinois Univ., Urbana. Dept. of Physics.
SPIN EFFECTS ON TRIANGLE GRAPHS
Melvin Month 1966 18 p refs
(Contract Nonr-1834(05))
(AD-634339) CFSTI: HC $1.00/MF $0.50

It is shown that the triangle amplitude can be written as the scalar graph multiplied by a factor which contains only the characteristics of the external particles. In the case where the spins of the external particles are summed, their angles averaged, and where only one particle wave set (that is, a set of relative orbital angular momenta among the final state particles) is retained, then this multiplicative factor is just a product of appropriate 3-momenta. The case K^+p to $K3\pi$ p at 3 Bev/c is considered; and it is demonstrated that the correct inclusion of threshold factors does not diminish the effect calculated by Halpern and Watson. Author (TAB)

N66-34231# California Univ., Los Angeles. Dept. of Physics.
THE POLARIZATION OF 45 MeV PROTONS BY COMPLEX NUCLEI
Thomas A. Cahill Jul. 1965 82 p refs
(Contract Nonr-233(44))
(P-70; AD-619061) CFSTI: HC $3.00/MF $0.75

Contents: Beam Generation; Experimental Beam Observations; Measurement and Spurious Asymmetries; Detectors and Electronics; Rotation of Polarization; Calibration of Polarization and Targets and Background. TAB

N66-34238# General Dynamics/Fort Worth, Tex. Nuclear Aerospace Research Facility.
EXPANSION OF FALLOUT-RADIATION NUMBER-SPECTRA CALCULATIONS TO LOW ALTITUDE Final Report, 20 Sep. 1965–20 Apr. 1966
O. L. Mc Dermed and T. W. De Vries 1 Jul. 1966 130 p refs
(Contract N228(62479)69007)
(FZK-291; AD-634534) CFSTI: HC $4.00/MF $1.00

Gamma-ray number and dose-rate spectra in the air above a smooth, quasi-infinite ground uniformly covered with fallout fission products are calculated. The spectra are calculated for 11 decay times, from 1.12 hours to 97.3 days, and at 7 altitudes, from 3 ft to 200 ft. The spectra are analyzed for the effects of altitude and decay time on spectral shape, with trends illustrated by computer tabulations and selected graphs. Results show that the spectra soften with increasing altitudes and that they soften with decay time for about 2 days, become slightly harder for about 3 weeks, then resume softening. Reduction of total dose rate with altitude is nearly independent of decay time (below 400 feet). A related study, to determine the effects of ground roughness, is recommended. Author (TAB)

N66-34239# Columbia Univ., Irvington, N. Y. Nevis Labs.
POSITRON SPECTRUM FROM MUON DECAY
John Peoples (Ph.D. Thesis) May 1966 164 p refs
(Contract Nonr-266(72))
(R-457; CU-253; Nevis-147; AD-634351) CFSTI: HC $5.00/MF $1.00

The positron spectrum from the decay of positive muons was studied using a sonic spark chamber spectrometer. An analysis of 1.1 million events gave a value for the Michel parameter of 0.750 ± 0.003. This number includes internal radiative corrections and is to be compared directly with the 0.750 predicted by the V-A theory. An upper limit on the mass of the muon neutrino was set at 1.5 MeV. Author (TAB)

N66-34280# Uppsala Univ. (Sweden). Quantum Chemistry Group.
LINKED CLUSTER THEOREM AND THE GREEN'S FUNCTION EQUATIONS OF MOTION FOR A MANY FERMION SYSTEM Scientific Report No. 3
Donald H. Kobe 1 Dec. 1965 48 p refs *Its* Preprint No. 162
(Contract AF 61(052)-874)
(ARL-66-0097; AD-633654) CFSTI: HC $2.00/MF $0.50

The equations of motion for the general many-time causal Green's functions for a fermion system are iterated and shown not to lead to unlinked graphs, which is a general proof of the linked cluster theorem. An explicit expression is obtained for the perturbation expansion of an arbitrary Green's functions which is applied to the one and two particle green's functions, by connecting lines systematically in a set of diagrams obtained from the equations of motion. The usual topologically different linked graphs and rules are generated. Author (TAB)

N66-34442*# AVCO-Everett Research Lab., Everett, Mass.
AIR RADIATION GRAPHS: SPECTRALLY INTEGRATED FLUXES INCLUDING LINE CONTRIBUTIONS AND SELF ABSORPTION
Richard A. Allen Washington, NASA, Aug. 1966 53 p refs
(Contracts NASw-748; DA-01-021-AMC-12005(Z))
(NASA-CR-556) CFSTI: HC $2.50/MF $0.50 CSCL 20H

The equilibrium radiation emitted from air was calculated over a range of temperatures from 2,000° to 23,000°K and over a density range from 10^{-6} to 10 atm. The calculations are presented in graphical form and are in terms of the radiation flux emitted from one side of infinite slabs of finite thickness. The molecular band systems were calculated using a smeared rotational model, and were carried out for a slab thickness of 1 cm. Atomic line and free-bound transitions are important contributors at elevated temperatures and also generally undergo significant amounts of self-absorption. Consequently calculations for these two classes of radiation have been made with slab thickness as an added parameter. The lines, free–bound and free–free radiation have also been split into the two spectral regions for the radiation flux above and below 2000 A. Author

N66-34471# Stanford Univ., Calif. High Energy Physics Lab.
A TEST OF THE ELECTRON PROPAGATOR BY MODIFICATION OF THE PRINCETON-STANFORD STORAGE RINGS
G. K. O'Neill May 1966 44 p refs
(Contracts Nonr-225(67); Nonr-1858(39))
(HEPL-440; AD-634717) CFSTI: HC $2.00/MF $0.50

The Princeton–Stanford colliding-beam experiment has verified quantum electrodynamics up to 1.1 GeV/c as far as the photon propagator is concerned., and further runs at 550 MeV

during 1966 will extend that limit a factor of three in sensitivity. In this report the question of modification of the rings for operation on positron-electron colliding beams at 550 MeV is discussed. It is pointed out that a conversion can be accomplished without major hardware changes, and that the resulting positron-electron storage ring could then be used for a very clean test of the electron propagator up to twice the invariant mass at which an apparent electrodynamic breakdown has been found at CEA. Author (TAB)

N66-34478# Uppsala Univ. (Sweden). Quantum Chemistry Group.
DIFFERENT ORBITALS FOR DIFFERENT SPINS. SOME RESULTS FOR THE LiH MOLECULE Scientific Report No. 6
Peter Lindner 15 Jan. 1966 37 p refs *Its* Preprint No. 166
(Contract AF 61(052)-874)
(ARL-66-0119; AD-634724) CFSTI: HC $2.00/MF $0.50

A trial was made to split the molecular orbital for the valence electrons in the LiH molecule. A comparison of the results obtained by use of wave function that is not a pure spin state function and one which is a pure singlet is made. Some comments on the different spin functions are made. The effect of different polarization of the outer Li-electron is discussed. Total energies and dopole moments are computed. Finally some remarks on the use of the virial theorem are made. Author (TAB)

N66-34541# Princeton Univ., N. J. Elementary Particles Lab.
OBSERVATION OF INTERFERENCE BETWEEN $\pi^+\pi^-$ AMPLITUDES FROM K_L DECAY AND COHERENT REGENERATION Technical Report Jun. 1964–May 1966
James S. Russ (Ph.D. Thesis) 16 May 1966 96 p refs
(Contract Nonr-1858(06))
(TR-42; AD-634498) CFSTI: HC $3.00/MF $0.75

A spark chamber–magnetic spectrometer search for interference between $\pi^+\pi^-$ decay amplitudes produced in free K_L decay, in apparent violation of CP invariance in the weak interactions, and from coherent regeneration was performed. Using diffuse beryllium regenerators of different mean densities, evidence was found for maximal constructive interference, independent of the K_S–K_L mass difference. Additional data using a solid beryllium regenerator provide good evidence that the magnitude of the mass difference lies in the interval $0.4 < \delta < 0.7$ in units of $\hbar/s$. Data were also taken on regeneration in liquid hydrogen and can be understood on the basis of large constructive interference with no anomalous effects. Optical model calculations of the phase of the regeneration scattering amplitude in beryllium indicate it is largely imaginary, so that the dominant contributions to CP violation are expected to come from the mass matrix and/or $\Delta I = 3/2$ currents. Implications of interference for CP conserving models are discussed. Author (TAB)

N66-34610# California Univ., Berkeley.
DIRECT SEARCH FOR THE C-VIOLATING NEUTRON DECAY YIELDING A NEUTRAL PI MESON + A POSITION AND AN ELECTRON
C. Baglin, A. Bezaguet, B. de Grance, F. Jacquet, P. Musset et al (Ecole Polytechnique, Paris) Jun. 1966 19 p refs
(Contract Nonr-3656(13))
(ONR-1-1966; AD-635061) CFSTI: HC $1.00/MF $0.50

No examples of the decay $\eta^0 \rightarrow \pi^0 e^+ e^-$ have been found in a sample of film containing 387 detected $\eta^0 \rightarrow \pi^0\pi^+\pi^-$. The film was with Ecole Polytechnique heavy liquid bubble chamber exposed to 950 MeV/c π^- at Saclay. With 90% confidence the branching ratio to $\eta^0 \rightarrow \pi^0 e^+ e^-$ is less than 0.23% of all η^0 baryons decays. Author (TAB)

N66-34611# Illinois Univ., Urbana. Dept. of Physics.
INTERPRETATION OF THE N* EFFECT IN DEUTERON COMPTON SCATTERING
Melvin Month [1966] 21 p refs
(Contract Nonr-1834(05))
(AD-635483) CFSTI: HC $1.00/MF $0.50

Calculations of deuteron Compton scattering based on impulse methods demonstrate a peaking of the energy distributions due to the N^* pole in the factored nucleon amplitude. It is suggested that the factorization procedure is questionable when a pole exists in the factored amplitude, as is evidenced, for example, by the failure of the impulse technique near threshold where the nucleon pole term is of importance. This difficulty is obviated by correctly treating the N^* as an intermediate state. An expression for the deuteron Compton differential cross section was derived. To avoid ambiguities inherent in the spin case, scalar particles were used. A comparison with the limited experimental data available above the photopion threshold produced very encouraging results.
Author (TAB)

N66-34714# Paris Univ., Orsay (France). Faculte des Sciences.
SCATTERING OF HIGH-ENERGY ELECTRONS ON PROTONS [DIFFUSION DES ELECTRONS DE HAUTE ENERGIE SUR LE PROTON]
Boris Dudelzak (Ph.D. Thesis) 1965 122 p refs In FRENCH *Its* Rept.-103
(NP-15943)

A theoretical and experimental study is made of the scattering of high energy electrons on protons. The concepts and relations defining the experimental conditions are used to interpret the experimental results. Kinematics of electron–proton elastic diffusion are first considered. The theoretical cross section of elastic scattering is then discussed and the theories used to interpret the experimental results are reviewed. The experimental devices, methods, and techniques are described in detail. The experimental results obtained are then reported. A theoretical and phenomenological interpretation is given of the results. NSA

N66-34715# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
STRIP APPROXIMATION WITH REGGE POLES AND BOOTSTRAP EQUATIONS FOR PION–PION SCATTERING
Martin Kretzschmar [1964] 41 p refs
(NP-15010)

A modified Regge representation was developed previously, distinguished from other Regge representations by the property that its analytic structure is of just the type required by Mandelstam's double dispersion relation. The use of this representation within the framework of a relativistic S-matrix theory for pion–pion scattering is discussed. An approximation to the exact scattering amplitude, termed the strip approximation, is defined as the sum of all possible contributions to the scattering amplitude from Regge poles in the direct or one of the crossed channels. This strip approximation combines the following features: analyticity properties as described by the Mandelstam representation, exact crossing symmetry, Regge behavior at high energies, and description of bound states and resonances at low energies and of forces due to the exchange of reggeized particles. Partial wave amplitudes are discussed, and the unitarity condition for complex angular momentum is introduced. A set of equations is then obtained that seems sufficient in principle for a self-consistent determination of the Regge trajectories located in the right half-plane, and of the background term of the scattering amplitude. Because of the complexity of the equations a numerical treatment is not yet in sight.
Author (NSA)

N66-34719# Paris Univ., Orsay (France). Faculte des Sciences.

STUDY OF THE D LAYER OF SOME NUCLEI BY ELECTRON SCATTERING [ETUDE DE QUELQUES NOYAUX DE LA COUCHE D PAR DIFFUSION D'ELECTRONS]

Roselyne Lombard (Ph.D. Thesis) 1964 135 p refs In FRENCH *Its* Rept.-67

(NP-15138)

The nuclear structure of ^{27}Al, ^{31}P, and ^{32}S was investigated by electron scattering at 100 to 190 MeV over angles from 40 to 135°. The parameters that define the charge density distributions for these nuclei were determined by elastic scattering. The multipolarities of transitions, reduced transition probabilities, and lifetimes of energy level were determined by inelastic scattering. The results were interpreted in terms of various models. NSA

N66-34720# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).

NUCLEAR SPIN RELAXATION BY FIXED DAMAGE CENTERS IN IRRADIATED $NaH_3(SeO_3)_3$

R. Blinc and I. Zupancic Dec. 1964 4 p refs Submitted for Publication

(NIJS-R-444)

A single crystal of $NaH_3(SeO_3)_2$ was exposed to ^{60}Co gamma rays at room temperature. The proton spin-lattice relaxation time in the $NaH_3(SeO_3)_2$ was measured as a function of irradiation time and of temperature. NSA

N66-34721# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

VARIABLE-ENERGY NEUTRON ACTIVATION ANALYSIS Final Report

E. L. Steele 17 Sep. 1965 44 p refs

(Contract AT(04-3)-167)

(GA-6691) CFSTI: HC $2.00/MF $0.50

Results obtained with neutrons produced with deuterons of ≤ 7 Mev and ^3He ions of ≤ 12 Mev bombarding targets of Li, Be, or B are described. Systems such as the $^{56}Fe(n,p)^{56}Mn$ – $^{59}Co(n,\alpha)^{56}Mn$, $^{16}O(n,p)^{16}N$ – $^{19}F(n,\alpha)^{16}N$, and $^{52}Cr(n,p)\ ^{52}V$ – $^{55}Mn(n,\alpha)^{52}V$ were investigated and found to be amenable to the technique of variable-energy neutron irradiations. Also investigated was the analysis of several copper-base alloys which are generally not feasible by D–T neutron methods, owing to the large amount of ^{62}Cu and ^{64}Cu produced. Short-lived products, such as 5.79-min ^{51}Ti, from the $^{51}V(n,p)^{51}Ti$ reaction, and 2.27-min ^{28}Al, from the $^{31}P(n,\alpha)^{28}Al$ reaction, were selectively produced from predominantly copper samples. Neutron yields from a series of $(^3He,n)$ reactions were compared with those from a 14 Mev neutron source (D–T), using the reactions $^{16}O(n,p)^{16}N$ and $^{28}Si(n,p)^{28}Al$ as measures of the fast-neutron yields. It was found that ^3He ions of ≤ 12 Mev produce a fast-neutron flux that is equivalent to a D–T produced flux of approximately 10^8 n/cm^2-sec per μa of beam current, using either a Li, Be, or B target. In general, the results indicate that the minimum variable-energy neutron source should be able to accelerate protons to 8 to 10 Mev, deuterons to 4 to 5 Mev, and ^3He ions to 12 to 15 Mev. Extracted beam currents should be 50 μa, or better. The source should be a cyclotron, in order to conserve on installation space and shielding requirements. Additional beam power would be desirable, in terms of increased sensitivity, but not if the price exceeds the $100,000 range. Ideally, the source would be a variable-energy machine; however, lower particle energies can be obtained from a fixed-energy machine by using stacked-foil techniques. The foil method does increase the low-energy neutron yield with deuterons and produces poor neutron-energy resolutions with protons and ^3He ions. NSA

N66-34724# Nordisk Institut for Teoretisk Atmofysik, Copenhagen (Denmark).

ELEMENTARY INTRODUCTION TO ELEMENTARY PARTICLE PHYSICS

J. Hamilton 1965 239 p Lectures presented at the Niels Bohr Inst. and NORDITA, Copenhagen, 1964–1965

(NP-15902)

Basic ideas involved in elementary particle processes are discussed. In particular, discussions are presented on the phase space factor; the Dalitz–Fermi plot, applications of the Dalitz plot, covariant formulation of transition rates, angular momentum, the operations C, P, T, particle-antiparticle conjugation C, time reversal T, time reversal in field theory, theorems on the CPT and decay processes, meson (K^0) decays, and G-parity. NSA

N66-34725# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Institut fuer Kernphysik.

NUCLEAR-SPECTROSCOPIC INVESTIGATIONS USING (n,pγ)-REACTIONS AND (n,$\alpha\gamma$)-REACTIONS [KERNSPEKTROSKOPISCHE UNTERSUCHUNGEN MIT HILFE VON (n,p γ)- UND (n,$\alpha\gamma$)-REAKTIONEN]

R. Bass 1965 84 p refs In GERMAN; ENGLISH Summary

(IKF-13)

A method of using a scintillation crystal both as target and detector for neutron-induced reactions was extended by the observation and analysis of coincident γ-radiation. Thereby improved separation and identification of individual final states as well as information on their modes of γ-deexcitation could be obtained. K(Tl) and Na(Tl) crystals were employed at various neutron bombarding energies between 4 and 14 MeV. Low lying states of the final nuclei ^{39}Ar, ^{36}Cl, ^{23}Ne and ^{20}F produced in (n,p) or (n,α) reactions of the target nuclei ^{39}K and ^{23}Na, were studied. Pulse shape-discrimination was used where necessary to identify the reaction products and to eliminate background. In addition to normal p-γ or α-γ coincidence measurements, triple coincidence measurements were performed with the sumcoincidence technique. For selected final states absolute production cross sections and γ-ray angular distributions were measured, and analyzed by appropriate theories assuming a compound nucleus reaction mechanism. NSA

N66-34726# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

SEARCH FOR A HEAVY ELECTRON BY ELECTRON-PROTON COINCIDENCE MEASUREMENTS

H. J. Behrend, F. W. Brasse, J. Engler, E. Ganssauge, H. Hultschig et al Aug. 1965 24 p refs Prepared in cooperation with Technische Hochschule, Karlsruhe, W. Germany

(DESY-65/9; KFK-362)

An attempt was made to observe the production of heavy electrons in the mass region of 500 to 1000 MeV in electron-proton interactions by measuring electron–proton coincidences from the interaction $e+p \rightarrow e^*+p \rightarrow e+\gamma+p$. It was found that no heavy electron exists in this mass region. A rise in the cross section was observed and was identified as the electroproduction of pions around the 2.10-BeV mass of the π-N system. NSA

N66-34727# Brookhaven National Lab., Upton, N. Y.

THE INTERACTION OF POLARIZED NEUTRONS WITH POLARIZED He^3 NUCLEI ADSORBED IN ZEOLITE

R. I. Schermer and L. Passell [1965] 7 p refs Presented at Intern. Conf. on the Study of Nucl. Struct. with Neutrons, Antwerp

(Contract AT(30-2)-GEN-16)

(BNL-9195; CONF-650706-15) CFSTI: HC $1.00/MF $0.50

A detailed description of the experimental procedure is included. The theory of the cross section for a polarized neutron beam interacting with an ensemble of polarized nuclei is presented. The results and a Curie–Weiss plot of the data are given. NSA

N66-34729# Commissariat a l Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

ANALYSIS OF RESONANCES DUE TO s WAVE NEUTRONS IN TRANSMISSION TIME-OF-FLIGHT EXPERIMENTS. II: WITH AN INTERFERENCE TERM [ANALYSE DES RESONANCES DUES AUX NEUTRONS "S" DANS LES EXPERIENCES DE TRANSMISSION PAR TEMPS DE VOL II: AVEC TERME D'INTERFERENCE]

Charles R. Corge Apr. 1965 98 p refs In FRENCH *Its* Rept.-12
(CEA-R-2780)

Various methods of analyzing resonances induced by wave neutrons in transmission time-of-flight experiments are described. Interference between resonant and potential scattering is not neglected. A single program is described, where one can find the partial-areas method and also the so-called method of the width at depth f of the dip.
Author (NSA)

N66-34730# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

MONTE-CARLO METHOD FOR STUDYING THE SLOWING DOWN OF NEUTRONS IN A THIN PLATE OF HYDROGENATED MATTER [METHODE DE MONTE-CARLO POUR L'ETUDE DU RALENTISSEMENT DES NEUTRONS DANS UNE PLAQUE MINCE DE MATIERE HYDROGENEE]

Pierre Ribon and Andre Michaudon Jun. 1965 31 p refs In FRENCH
(CEA-R-2804)

A Monte Carlo method for the study of the slowing down of neutrons, particularly the intensity and time distribution of the slowed-down neutrons, is described. NSA

N66-34734# California Inst. of Tech., Pasadena.

APPLICATIONS OF THE ALGEBRA OF CURRENT COMPONENTS

Roger F. Dashen and Murray Gell-Mann May 1965 11 p refs
(Contract AT(11-1)-68)
(CALT-68-37) CFSTI: HC $1.00/MF $0.50

Some applications of the nonchiral U(6)×U(6) group for the hadrons at rest and the related algebraic properties of the weak and electromagnetic currents are discussed. Only the (56, 1)$^+$ baryons B and the (6, $\bar{6}$)$^-$ mesons M are considered. The known Lorentz transformation properties of the U(6)×U(6) operators, as space integrals of components of scalar, tensor, vector, and axial vector densities, are used to examine the matrix elements of the operators between moving states of the particle composing the U(6)×U(6) representations, assuming mass degeneracy among the supermultiplet members. Predictions for electromagnetic form factors are discussed. The application of the hybrid group U(6) to collinear S-matrix elements is considered. It is found that the more successful predictions of approximate higher symmetry for the 36 M mesons and the 56 B baryons can be obtained by using the positive parity algebra of U(6)×U(6) as a rough symmetry of the states at rest. NSA

N66-34735# Purdue Univ., Lafayette, Ind.

STRANGE PARTICLE PRODUCTION IN 2.7 GeV/c π^-p INTERACTIONS

D. H. Miller, A. Z. Kovacs, R. L. Mc Ilwain, G. W. Taotfest, and T. R. Palfrey [1965] 22 p refs
(Contract AT(11-1)-1428)
(COO-1428-12) CFSTI: HC $2.00/MF $0.50

A total of 1514 strange particle events were analyzed in a sample of 30,000 pictures of incident 2.7 Bev/c π^- in the 72-in. hydrogen bubble chamber. Strong resonance production is observed, particularly K*(888), Y_1^*(1385), and Y_0^*(1405 and 1520). In general, baryon systems are peaked sharply backward in the center of mass system consistent with one-particle exchange. Partial cross sections and a study of all final states are presented. The total strange particle cross section at this energy is calculated to be 1.49±0.07 millibarns. Author (NSA)

N66-34740# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

THERMALIZATION TIMES OF LOW-ENERGY ELECTRONS IN RARE GASES

G. L. Braglia, G. M. De'Munari, and G. Mambriani Dec. 1965 13 p refs
(RT-FI-(65)-61)

The thermalization time of electrons is given in helium, neon, argon, krypton and xenon, as a function of the initial electron energy and of the gas temperature. This time was calculated by numerical integration of the slowing-down equation which takes into account only the elastic collisions of the electrons. The best available values of the momentum-transfer cross sections were used. Author (NSA)

N66-34741# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

A NEW TECHNIQUE FOR PLUTONIUM PARTICLE SIZE ANALYSIS

B. V. Andersen 7 Jun. 1965 14 p refs
(Contract AT(45-1)-1830)
(BNWL-SA-26) CFSTI: HC $1.00/MF $0.50

A procedure to determine plutonium particle sizes based on the concept of fission fragment damage to plastics, glasses, and natural crystals is described. The availability of a high thermal neutron flux and the good thermal fission cross-section of plutonium isotopes contribute to make the fission fragment damage phenomena a sensitive analytical tool for plutonium. Integrated neutron flux of from 10^{13} to 10^{17} nvt are employed to create damage sites in three-mil plastic film at locations covered by plutonium particles. Holes are etched in the plastic in the damaged locations by treatment in a warm caustic solution. Particle sizes in the submicron range are easily measured. Particle size distributions obtained by the autoradiographic alpha track film and by the fission fragment damage phenomena are illustrated and discussed. NSA

N66-34753# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

FISSION BY RADIATIONLESS TRANSITION IN THE MU MESONIC ATOM ^{239}Pu

V. Cojocaru, A. Ignatenko, L. Marinescu, M. Omelianenko, M. Petrascu et al 13 Nov. 1965 8 p refs Submitted for Publication
(JINR-D-2427)

The ratio of the radiationless probability and conventional fission of ^{239}Pu in mu-mesonic atoms were measured with a gas scintillation-fission counter-chamber. The great contribution of the radiationless fission mechanism is observed. The increase of the probability of radiationless fission appears to be due to the change of the nuclear fission barrier under the effect of mu-mesons predicted by Zaretsky et al.
Author (NSA)

N66-34760# Gosudarstvennyi Komitet po Ispolzovaniye Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.

GREEN'S FUNCTION FOR A COULOMB POTENTIAL [O FUNKTSII GRINA DLYA KULONOVSKOGO POTENTSIALA]

A. M. Perelomov and V. S. Popov 12 Jul. 1965 22 p refs In RUSSIAN; ENGLISH summary
(NP-15794)

An expansion of the Coulomb Green function (for E>0) over irreducible infinite-dimensional representations of the Lorentz group is obtained. The special case when the dynamical symmetry group of the hydrogen atom contracts to nonrelativistic Galilei group is also considered. An explicit expression for the Green function of the Kepler problem in the n-dimensional space is obtained. Author (NSA)

N66-34768# Maryland Univ., College Park. Dept. of Physics and Astronomy.
HIGH ENERGY BEHAVIOR OF SCATTERING AMPLITUDES AND CROSS SECTIONS USING CROSSING SYMMETRY AND HOLOMORPHY IN TWO VARIABLES
R. J. Eden Dec. 1965 8 p refs
(Grant AF-AFOSR-500-64)
(TR-532; AD-634706) CFSTI: HC $1.00/MF $0.50

For a symmetric amplitude $F_+(Z,t)$ (for example the sum of positive pion-proton and negative pion-proton scattering amplitudes), where $Z = E + t/4m$ and E is the centre of mass energy; crossing symmetry and hermitean analyticity lead to the relation, for Z real, $F_+(-Z+iO,t) = F_+^*(Z+iO,t)$. This is an exact relation and can be used to determine not only the phase of the leading term for large Z, but also of other terms except for ambiguities in sign, which are resolved by other conditions. In this paper smooth functions are used that involve powers of E or of log E for which one can easily show that if $\mathrm{Im} f_+(E) = E^\alpha$, then $f+(E) = (-iE)^\alpha C$; if $\mathrm{Im} f_+(E) = (\log E)^\beta$, then $f_+(E) = +(\log E - i\pi/2)^\beta$, scattering by Meiman. It is the main purpose here to show how these results from crossing and analyticity in E can be combined with holomorphy in the variable t and temperedness in E within the domain of holomorphy. The method is a general one but its effect is most spectacular in the neighbourhood of the Greenberg-Low bound. Author (TAB)

N66-34770# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ION SOURCE WITH LONGITUDINAL MAGNETIC FIELD
S. V. Starodubtsev and V.A. Muminov 20 Jan. 1966 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Mat. i Tekhn. Nauk (Baku), no. 1, 1965 p 57-59
(FTD-TT-65-1474; AD-634814) CFSTI: HC $1.00/MF $0.50

A source of hydrogen ions is described which features a low pressure glow discharge with a magnetic field directed along the discharge axis. TAB

N66-34781# Naval Radiological Defense Lab., San Francisco, Calif.
ENERGY AND ANGULAR DISTRIBUTION OF GAMMA RAYS SCATTERED IN ALUMINUM
John G. Dardis and Norman E. Scofield 22 Dec. 1965 40 p refs
(USNRDL-TR-1018; AD-634919) CFSTI: HC $2.00/MF $0.50

The energy and angular distribution of plane perpendicular Cs^{137} gamma rays scattered in 1 through 5 mean free paths of aluminum was measured using a NaI(Tl) spectrometer. The results are compared with distributions calculated from the method of moments and polynominal expansion. For 1 and 2 mean free paths the infinite-medium calculations for multiple scatter are considerably in excess of the experimental results at the distribution peak; otherwise, the spectrum shape is reproduced satisfactorily. For 3, 4, and 5 mean free paths the calculations are in good agreement with experiment. Author

N66-34893# Stanford Univ., Calif.
CHARGE STRUCTURE OF THE CALCIUM ISOTOPES
B. F. Gibson and K. J. van Oostrum May 1966 39 p refs Submitted for Publication
(Contracts AF 49(638)-1389; Nonr-225(67); Grant NSF GP-948)
(ITP-215; HEPL-441; AD-634295) CFSTI: HC $2.00/MF $0.50

Phenomenological models of the ground state charge densities of the calcium isotopes $Ca^{40,44,48}$ exhibit both an increase in the half-radius which is less than one would expect from a simple $A^{1/3}$ estimate and an uneven variation in the skin thickness. A simple shell model of the nucleus with a Woods-Saxon potential is presented which can produce charge densities leading to electron scattering cross sections which agree with experiment as well as the phenomenological analyses. Strong closed shell effects are found in the parameters describing the potential half-radius and skin thickness. Author (TAB)

N66-34969# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
STUDIES AND EXPERIMENTAL WORK ON ATOMIC COLLISION PROCESSES OCCURRING IN ATMOSPHERIC GASES Technical Report, 22 Dec. 1964-22 Dec. 1965
A. V. Phelps and W. H. Kasner Kirtland AFB, N. Mex., AF Weapons Lab., May 1966 73 p refs /ts Res. Rept.-66-6E2-GASES-R1
(Contract AF 29(601)-6729)
(AFWL-TR-66-34; AD-635219) CFSTI: HC $1.50/MF $0.75

Temperature dependent recombination studies in nitrogen were conducted over the range 200°-480°K, yielding a coefficient of $(2.9\pm0.3)\times10^{-3}$ cm^{-3}/sec for the recombination of N_2^+ ions and electrons. The observed temperature dependence is quiet small, being adequately described by the relation $T^{-0.02}$. Several modifications have been made on the flow system used in the study of associative detachment in O_2-O mixtures. In subsequent studies a reaction resembling associative detachment was observed. While preliminary tests were being conducted on the rf mass spectrometer which is to be used on the flow system, a brief study of negative ion-molecule reactions was made. Rate coefficients for several of these reactions were measured. A summary of the results of a calculation of momentum transfer and inelastic cross sections for electrons in oxygen is presented. The computed momentum transfer cross section is in satisfactory agreement with electron beam results but it differs significantly from the cross section obtained at thermal energies from microwave experiments. Author (TAB)

N66-34972# Alabama Univ., University.
SINGLE LEVEL MUON CAPTURE CALCULATIONS FOR C^{12} AND O^{16} Interim Technical Report
R. F. Jacob and J. N. Huffaker May 1966 86 p refs
(Grant DA-ARO(D)-31-124-G664)
(AROD-4819-1; AD-635312) CFSTI: HC $3.00/MF $0.75

Assuming the validity of the Universal Fermi Interaction hypothesis, comparison of theoretical single level muon capture rates with experimental data may prove valuable in determining the form and extent of renormalization of the nucleon-lepton weak interaction Hamiltonian density (the magnitudes of the induced form factors). To this end the muon capture transition probabilities were calculated for the $C^{12} \rightarrow B^{12}$ (ground state to ground state) and the $O^{16} \rightarrow N^{16}$ ($0^+ \rightarrow 0^-$), $0^+ \rightarrow 1^-$) transitions. Analysis of experimental results for these rates permits the computation of a region of possible values for the induced pseudoscalar g_p and induced tensor g_T form factors. The results are qualitatively in agreement with theoretical predictions of $g_p = 8\lambda$, where $g_T = 0$. The muon wave functions are corrected for finite nuclear size and relativistic effects, which are found to be not entirely negligible, even for the ratio of O^{16} capture rates. Author (TAB)

N66-34988*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXCITATION OF H-ATOMS BY FAST PROTONS
Ian M. Cheshire and H. Lee Kyle Dec. 1965 10 p Submitted for Publication
(NASA-TM-X-57163; X-641-65-505) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A simple formula for the total Born cross section for the excitation of ground state H-atoms to any excited state n is given and a table of cross sections is included for representative n and impact energies. Author

N66-35060# California Univ., Los Angeles. Dept. of Physics.
ENERGY AND ANGULAR CORRELATIONS IN THE C^{12} (P,2P) B^{11} REACTION AT 45.5 MEV
Kenneth E. Richie (Ph.D. Thesis) May 1966 99 p refs
(Contract Nonr-233(44))
(P-75; AD-634869) CFSTI: HC $3.00/MF $0.75

The angular correlation of the two protons emitted from the $C^{12}(P,2P)B^{11}$ reaction at 45.5 MeV was measured with one detector fixed at 30 degrees and the other rotated from 20 degrees to 140 degrees, in steps of 10 degrees, on the opposite side of the beam line. The energy sharing of the two protons was also determined, using two dimensional analysis by an on-line computer system. The results were fit with a computer program based on the distorted wave theory.
Author (TAB)

N66-35081# Istituto Superiore di Sanita, Rome (Italy).
STUDY OF THE REACTIONS (E, E'P), (E, E'N) AND (E, E'α USING THE EXTRACTED BEAM OF THE FRASCATI ELECTRONSYNCHROTRON [STUDIO DELLE REAZIONI (E,E'P), (E,E'N), (E,E'α) UTILIZZANDO IL FASCIO ESTRATTO DELL'ELETTROSINCROTRONE DI FRASCATI (PROPOSTA D'ESPERIENZA)]
G. Campos Venuti, G. Cortellessa, E. de Sanctis, G. Farchi, S. Frullani et al 20 May 1966 66 p refs In ITALIAN
(ISS-66/20) CFSTI: HC $3.00/MF $0.75

On the basis of the results obtained with (e,e'p) experiments, using the internal beam of the Frascati electronsynchrotron, a new experiment is proposed, using the external beam, to study the reactions (e,e'p),(e,e'n) and (e,e'α). After a discussion of the study of these reactions within the framework of nuclear physics research, different experimental solutions for detecting scattered particles and their advantages and disadvantages are examined. Due to the complexity of the measurements and the data reduction, an important part of this paper is devoted to the logic of the experiment. Finally, an estimate of the expected counting rate and the unavoidable accidentals is presented. Author

N66-35098# Army Electronics Labs., Fort Monmouth, N. J.
DIRAC MONOPOLE SEARCH
Harry Berkowitz and Stanley Kronenberg May 1966 37 p refs
(ECOM-2710; AD-635253) CFSTI: HC $6.00/MF $0.50

The general aspects of the Dirac monopoles are discussed. A novel experiment is proposed by means of which one could prove the existence of the monopoles with magnetic charge $g \approx 137\ e$ provided that the cross section for their production is larger than 10^{-38} cm^2 above the re-

N66-35115# Naval Radiological Defense Lab., San Francisco, Calif.
ENERGY LEVELS OF ^{127}I
John P. Hurley and James M. Mathiesen 10 May 1966 39 p refs
(USNRDL-TR-1019; AD-635252) CFSTI: HC $4.00/MF $0.50

Gamma ray singles and coincidence measurements were made on the radiations from the ^{127m}Te, $^{127}Te \rightarrow {}^{127}I$ decay sequence. Gamma-ray intensities were measured, log ft values were computed, and spin-parity assignments were made to the energy level of ^{127}I. A decay scheme is proposed on the basis of previous and present data. Author (TAB)

N66-35134# Osterreichische Studiengesellschaft für Atomenergie G.m.b.M., Seibersdorf (Austria). Physikinstitut.
CALCULATION OF THE FREQUENCY OF LOCALIZED GRID OSCILLATIONS [BERECHNUNG DER FREQUENZ VON LOKALISIERTEN GITTERSCHWINGUNGEN]
Ewald Balcar Oct. 1965 14 p refs In GERMAN Presented at the Autumn Meeting of the Austrian Phys. Soc., Vienna, 1965 Submitted for Publication Supported in part by the U.S. Govt.
(SGAE-PH-42/1966) CFSTI: HC $1.00/MF $0.50

The frequency of a localized defect oscillation in the Pb crystal lattice, containing an In impurity atom, was calculated by forming the dynamic matrix of the crystal structure. Computed were the central elastic forces between one atom and its first, second, and third neighbors, together with the additional elastic parameters of the tensor forces between next neighbors. Depending on the properties of the interstitial atom, the self-induced oscillations either shifted to lower or higher values within the crystal frequency band. Comparison with experimental results on the system $Pb_{0.97}$ $In_{0.03}$ established an additional frequency band at 9.5 MeV when compared with the frequency of pure lead; good agreement with calculated values was found. Transl. by G.G.

N66-35140# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
CALCULATION OF PARTIAL WAVE ABSORPTIONS AND OF THE MODULI OF THE ELASTIC AMPLITUDES IN NUCLEON–NUCLEON SCATTERING BELOW 1.4 GeV
U. Amaldi, Jr., R. Biancastelli, and S. Francaviglia 16 Apr. 1966 64 p refs
(ISS-66/15) CFSTI: HC $3.00/MF $0.75

The usual procedure to compute partial wave absorptions in pion–pion and pion–nucleon scattering from the knowledge of the inelastic processes is extended to the nucleon–nucleon case and applied to the range 550–1400 MeV of laboratory kinetic energies. One pion production, which is the only important inelastic channel, is described by means of the well-known peripheral model modified by the introduction of form factors. Contrary to a general belief, the results show that this model does not violate any of the unitarity conditions, which in the present case are not at all trivial due to the non-diagonal character of the S-matrix in the angular momentum representation. From the computed absorptions the moduli of the partial wave elastic matrix elements are obtained. Author

N66-35183*# Washington Univ., St. Louis, Mo.
IS THE GRAVITON A GOLDSTONE BOSON?
Peter R. Phillips 1966 10 p refs
(Grant NsG-581)
(NASA-CR-77493) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The Nambu theory of elementary particles is examined. We encounter grave difficulties if we insist upon Lorentz invariance. But the model provides an ether, which can violate Lorentz invariance. By taking this idea completely seriously, we can show how the photon and the graviton arise as collective oscillations, and can estimate their coupling constants. These fields travel with velocity c in spite of being collective oscillations, so that classical experiments seem to have no bearing on the existence of an ether. A new experiment to look for the ether is described. Author

N66-35204*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
NEUTRON CROSS SECTIONS FOR CADMIUM ISOTOPES
Topical Report
M. K. Drake 25 Mar. 1966 73 p refs
(Contract SNPC-27)
(NASA-CR-54933; GA-6997) CFSTI: HC $2.50/MF $0.75 CSCL 20H

A literature survey on neutron cross section measurements of cadmium and its isotopes (Cd-110, Cd-111, Cd-112, Cd-113, Cd-114, and Cd-116) is presented. Total cross section measurements over the energy range 0.008 eV to 500 eV are reported, and data for capture, nonelastic, (n, 2n), (n, p), and (n, α) cross sections are discussed. Measurements and calculations for elastic and inelastic scattering are also mentioned. Tables and graphs are included for the data. N.E.N.

N66-35246# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THE OBTAINING OF APPROXIMATE EQUATIONS FOR THE SCATTERING MATRIX ELEMENTS IN THE RELATIVISTIC THREE-BODY PROBLEM
V. P. Shelest and D. Stoyanov 9 Apr. 1965 7 p refs
(JINR-E-2108)

Approximate equations were obtained for the elements of the three-body scattering matrix in the case of the particle scattering on the bound two-body states with strong and weak coupling. Author (NSA)

N66-35247# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THE ORBITAL FRACTIONAL PARENTAGE COEFFICIENTS FOR TWO AND THREE NUCLEONS IN THE 2 SLD SHELL IN THE SU(3) CLASSIFICATION SCHEME
Z. Pluhar 20 Jul. 1965 9 p refs
(JINR-E-2285)

Tables are given for the orbital fractional parentage coefficients for 2 and 3 nucleons in the SU(3) scheme and for the matrix elements of central Wigner force between two nucleon states. Author (NSA)

N66-35251# Iowa State Univ. of Science and Technology, Ames.
THE $Pr^{141}(\gamma,n)Pr^{140}$ CROSS SECTION IN THE GIANT RESONANCE REGION
Ronald Gordon Johnson (M.S. Thesis) Feb. 1966 60 p refs
(Contract W-7405-ENG-82)
(IS-T-78) CFSTI: HC $3.00/MF $0.75

The cross section for the $^{141}Pr(\gamma,n)^{140}Pr$ reaction was studied in 0.125-MeV steps over the giant resonance region, 9.125 to 24,000 MeV. Radioactivity yield curves were analyzed by Least Structure Analysis. Eleven distinct resonances were resolved in the giant resonance region. The integrated cross section over this region was 1.79±0.1 MeV-barns.
Author (NSA)

N66-35261# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
CROSS SECTIONS FOR ELECTRON–POSITRON PAIR PRODUCTION BY γ QUANTA (E γ=10–10000 MeV) IN HYDROGEN, CARBON, FLUORINE, CHLORINE, BROMINE AND XENON [SECHENIYA OBRAZOVANIYA ELEKTRON-POZITRONNIKH PAR V VODORODE, UGLERODE, FTORE, KHLORE, BROME I KSENONE γ-KVANTAMI S E γ=10–10000 MeV]
Ya. Bem and V. G. Grishin 21 Mar. 1966 27 p refs In RUSSIAN
(JINR-P-2636)

Cross sections for electron–positron pair production by γ-quanta (Eγ=10–10000 Mev) in hydrogen, carbon, fluorine, chlorine, bromine, and xenon were calculated.
Author (NSA)

N66-35265# Kernforschungszentrum, Juelich (West Germany). Institut fuer Reaktorentwicklung.
THERMAL EFFECTIVE CROSS SECTION AND RESONANCE ABSORPTION INTEGRALS OF FISSION PRODUCTS [THERMISCHE WIRKUNGSQUERSCHNITTE UND RESONANZABSORPTIONSINTEGRALE VON SPALTRODUKTEN]
E. S. Stippel Dec. 1965 29 p refs In GERMAN
(JUL-354-RG)

The thermal effective cross sections and resonance integrals of fission products and isotopes were compiled from original studies and reports published since 1956. No evaluation of the data is made, and when several values are available for the same isotope all are given without comment.
Author (NSA)

N66-35278# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
A HIGH PRESSURE VESSEL FOR THE MEASUREMENT OF PRESSURE INDUCED PHONON ENERGY SHIFTS BY INELASTIC SCATTERING OF NEUTRONS
Reupert Lechner 28 Apr. 1966 21 p refs Submitted for Publication
(SGAE-PH-43/1966) CFSTI: HC $1.00/MF $0.50

A pressure vessel for neutron inelastic scattering experiments at 3000 atm maximum pressure is described. Rather thin walls with good neutron transmission properties are obtained by composing the vessel of five cylinders made of a high-strength aluminum alloy which are shrinked one upon another. This compound cylinder has a total wall-thickness of only 13.5 mm for a (cylindrical) sample volume of 30.6 mm diameter and 65 mm length. The whole range 2π of scattering angles is accessible. Certain relations are discussed which were used in calculating optimal cylinder dimensions. Experiments with a lead single crystal show a reduction of Bragg peak intensity to 76% if the crystal is mounted in the vessel. A typical measurement at 3000 atm gives an increase of 2% in phonon energy. Author

N66-35280# European Organization for Nuclear Research, Geneva (Switzerland).
PION–PROTON ELASTIC SCATTERING
M. N. Focacci and G. Giacomelli 25 Apr. 1966 33 p refs
(CERN-66-18)

A review is presented of the phenomenological situation of pion-proton elastic scattering, with emphasis placed on high energy data. The high energy angular distributions are divided into three regions: (1) the very small angles [$|t|<0.01$ (GeV/c)^2] where the Coulomb scattering contribution is important, (2) the diffraction region proper [$t=0.01<t<1$), and (3) the large angle region [$|t|>1$ (GeV/c)^2]. The various optical models most frequently used in the literature are described along with a survey of the experimental data. The Born approximation, statistical models, Regge poles, and other phenomenological models are discussed. Assumptions are that the conservation laws usually accepted for strong interactions are valid for pion-nucleon scattering, with extensive use made of the isospin conservations. C.T.C.

N66-35290# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
MEASUREMENT OF ELECTRONS MOMENTUM BY SPARK CHAMBERS IN MAGNETIC FIELD [MISURA DELLA QUANTITA DI MOTO DI ELETTRONI, CON CAMERE A SCINTILLA POSTE IN CAMPO MAGNETICO]

G. Farchi 27 Apr. 1966 28 p refs In ITALIAN; ENGLISH summary
(ISS-66/18) CFSTI: HC $2.00/MF $0.50

The aim of this study is the calculation of the precision that is possible to attain in the measurement of the momentum of electrons deflected by a magnetic field and detected in the field by 3 to 4 one gap spark chambers. The momentum error is calculated starting from the measurement errors in each chamber. Author

N66-35294# European Organization for Nuclear Research, Geneva (Switzerland).
INTRODUCTION TO THE STUDY OF LINEAR ACCELERATORS [INTRODUCTION A L'ETUDE DES ACCELERATEURS LINEAIRES]
P. Lapostolle 7 Jun. 1966 84 p refs In FRENCH, ENGLISH summary
(CERN-66-20)

This work should be considered as a course or as an introduction to the study of linear accelerators, rather than as an extensive report making a completely up-to-date review of all linear accelerator problems. It endeavours to collect together the basis of theory and the relevant technical ideas, which are usually dispersed among many reports, though it has no pretensions to being complete. Emphasis is placed on proton linacs, though electrons and heavy ions are also included. The presentation is dictated by pedagogical concern, but a table of contents will guide the reader in finding the appropriate chapters. Author

N66-35295# European Organization for Nuclear Research, Geneva (Switzerland).
$SU_2 \rightarrow SU_3 \rightarrow SU_6$
V. F. Weisskopf 24 May 1966 91 p Lectures presented during spring and autumn, 1965
(CERN-66-19)

A series of lectures intended to give a simple and primitive description of unitary symmetries as applied to high energy physics by building from SU_2, then SU_3 and eventually to SU_6 are presented. Generalities about SU_3 symmetries are discussed, and include such topics as adjoint spinors, direct products of spinors, basic triplet representation spaces of u spin and v spin, generating operators for SU_3, and products of three quarks. Consideration is given to breaking the SU_3 symmetry, and incorporates electromagnetic properties, magnetic moments of baryons, and mass formulas. The question of the two octets is taken up for baryon–meson interactions by considering such topics as baryon–meson f and d couplings, two octets and the mass formula, and derivation of the diagonal matrix. SU_6 symmetry is investigated by means of quark pairs, generating operators, the boson spectrum, quark triplets, magnetic moments, mass formula, baryon–meson interactions, and weak interactions. C.T.C.

N66-35296# Portugal. Nuclear Energy Commission, Sacavem. Physics Div.
ON AN AXIOMATIC CONSTRUCTION OF THE THEORY OF THE LINEAR ULTRA-DISTRIBUTIONS AND SOME OF ITS POSITIVE MODELS [SOBRE UMA CONSTRUCAO AXIOMATICA DA TEORIA DAS ULTRA-DISTRIBUICOES NA RECTA E ALGUNS DOS SEUS POSSIVEIS MODELOS]
Antonio de Sousa e Meneses 17 Jun. 1965 15 p refs In PORTUGEUSE Presented at the 17th Porto-Spanish Congr. for the Progr. of Sci., Bilbao, Spain, 20–24 Jul. 1964
(LFEN-38(α)) CFSTI: HC $1.00/MF $0.50

A mathematical concept for the axiomatic construction of linear ultra-distribution spaces, through the extension of certain operators, is presented. Properties of the Stieltjes transformation are discussed, and a new definition giving it more general domain of functional space is reported. A lemma is advanced, on a complex function limited in every compact interval; a corollary from the theorem of the Stieltjes transformation covers the holomorphous function of ultra-distribution in the domain mentioned. A model defining a linear application of the functional space domain of this transformation is constructed, and mathematical proof given. The solution to the problem is considered unique unless there is an operational isomorphism which permutes with specified operators. A model is derived to facilitate study of linear ultra-distribution space under various concepts (e.g., the value of an ultra-distribution on a point, the integral of an ultra-distribution on an interval). R.U.

N66-35307*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
APPLICABILITY OF PERTURBATION THEORY TO MOLECULAR PROBLEMS
Joseph O. Hirschfelder 11 Nov. 1965 32 p refs Presented at the Advanced Seminar on Perturbation Theory and its Appl. in Quantum Mech. Sponsored by Univ. of Wis. Math. Res. Center and by Theoret. Chem. Inst., Madison, Wis., 4–6 Oct. 1965 Submitted for Publication
(Grant NsG-275-62)
(NASA-CR-68474; WIS-TCI-135) CFSTI: HC $2.00/MF $0.50 CSCL 20J

This paper is a general survey of the ways in which low order perturbation theory is used in quantum mechanics to determine the energy and other properties of molecules. The various types of mathematical problems encountered are discussed. Author

N66-35315*# Alabama Univ. Research Inst., Huntsville. Dept. of Physics.
INTERNAL CONVERSION COEFFICIENTS FOR M4 TRANSITION FOR TELLURIUM
C. P. Bhalla [1965] 18 p refs Submitted for Publication
(Grant NsG-381)
(NASA-CR-68528) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Theoretical results of β_4 for the subshells including M-subshells are presented in the 81.78 KeV transition of ^{121m}Te. Numerical results for gamma energy equal to 0.15 mc^2 are also presented, and compared with the earlier calculations of Rose, and Sliv and Band. Atomic screening and the finite nuclear size effects are included accurately. The experimental data of Chu and Perlman compares favorably with the new theoretical results. The calculated eigenvalues are also found to be in reasonable agreement with the experimental binding energies. Author

N66-35316*# Maryland Univ., College Park. Inst. for Molecular Physics.
NONADDITIVITY OF INTERMOLECULAR FORCES: EFFECTS ON THE THIRD VIRIAL COEFFICIENT
A. E. Sherwood, Andrew G. De Rocco, and E. A. Mason 15 Oct. 1965 62 p refs Submitted for Publication
(Grant NsG-5-59)
(NASA-CR-68698; IMP-NASA-52) CFSTI: HC $3.00/MF $0.75 CSCL 20H

The effects of nonadditive three-body forces on the third virial coefficient C(T) are examined. Corrections to the dispersion and repulsion pair potentials are taken, respectively, from third-order perturbation theory without exchange (triple-dipole) and from first-order perturbation theory with exchange. The repulsion is examined for two specialized models, a one-electron Gaussian model and an electrostatic distortion model. The results for the nonadditivity are shown to agree reasonably well with the quantum-mechanical results on one- and

two-electron atoms. The magnitudes of the corrections to the repulsion and dispersion energies are of comparable magnitude but opposite sign for the ranges of interatomic separations of interest. Similarly, the correction to C(T) for repulsion nonadditivity is of opposite sign but comparable magnitude to that for dispersion nonadditivity in the temperature range of interest. The net correction, however, is of experimental significance. Author

N66-35320*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

THE GROUND STATE ENERGY OF A MOLECULE IN THE ADIABATIC APPROXIMATION

Saul T. Epstein 25 Aug. 1965 5 p refs Submitted for Publication

(Grant NsG-275-62)

(NASA-CR-68755; WIS-TCI-118) CFSTI: HC $1.00/MF $0.50 CSCL 20H

This paper attempts to correct a slight logical flaw in Brattsev's proof that the energy of the ground state of a molecule accurately calculated in the adiabatic approximation is a lower bound to the true energy of the ground state, and to materially simplify the proof. R.N.A.

N66-35322*# AVCO-Everett Research Lab., Everett, Mass.

AIR RADIATION TABLES: SPECTRAL DISTRIBUTION FUNCTIONS FOR MOLECULAR BAND SYSTEMS

Richard A. Allen Washington, NASA, Aug. 1965 194 p refs (Contracts NASw-748; DA-01-021-AMC-12005(Z))

(NASA-CR-557) CFSTI: HC $3.25/MF $1.25 CSCL 20H

Calculated spectral distributions are given in computer output and graphical form for the following diatomic molecular band systems found in air: CN (Violet), (Red); N_2 (1+), (2+), ($b'\Pi \rightarrow X$), ($b'^1\Sigma \rightarrow X$), (Lyman Birge Hopfield); N_2^+ (1−), (Meinel); NO (β), (γ), (Ogawa), and O_2 (Schumann-Runge). The calculations are carried out for 2000°, 5000°, 8000°, and 11,000° K. A smeared rotational line model is used and also the assumption is made that the electronic transition moments are independent of internuclear separation. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-34118# Army Missile Command, Huntsville, Ala.

THE SELF-FOCUSING OF INTENSE BEAMS OF RELATIVISTIC ELECTRONS

T. G. Roberts Jun. 1966 14 p

(AD-634634) CFSTI: HC $1.00/MF $0.50

It is shown that a beam of relativistic electrons can be extracted from the electrode space of an X-ray machine, and that these electrons will form a Bennett pinch or at least will not blow up when they enter an ionized medium. The pinched beam of electrons will travel more than 23 centimeters without blowing up, while an electron beam such as this when projected in vacuum blows up drastically in less than 2 centimeters. Author (TAB)

N66-34145# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A STUDY OF THE PROTECTIVE EFFECT OF A THIN FILM ON A SURFACE EXPOSED TO SPUTTERING

Robert Kelley Parker (M.S. Thesis) Mar. 1966 157 p refs (SP/PH/66-15; AD-633670) CFSTI: HC $5.00/MF $1.00

A serious problem in the design of plasma devices has been the erosion of material surfaces in contact with an energetic plasma. A technique for the protection of surfaces exposed to the destructive effects of sputtering was investigated. The technique involves the coating of a metallic substrate (tantalum) with a thin protective film of gallium. Although no quantitative measurements of the protective effect were obtained, the existence of the protective effect was definitely established. The effect was found to be substantial at ion energies near the threshold potential. However, the effect was found to have an upper limit near or below 100 eV. This protective effect would have its best application under conditions of high current density and low bombardment energies. Author (TAB)

N66-34164# Texas Univ., Austin. Electrical Engineering Research Lab.

A STUDY OF THE APPLICATION OF FINITE-DIFFERENCE TECHNIQUES TO ULF WAVES IN A SPHERICAL MODEL INHOMOGENEOUS, ANISOTROPIC, ATMOSPHERIC PLASMA

Carroll W. Chapman and Francis X. Bostick, Jr. 15 Apr. 1966 247 p refs

(Contract Nonr-375(14))

(Rept.-141; AD-633668) CFSTI: HC $6.00/MF $1.25

A finite difference analog is formulated for the linearized equations which govern the propagation of ulf waves in the ionized terrestrial atmospheric medium. The formulation is carried out in a spherical coordinate system. The model of the medium consists of a static magnetic dipole centered in a perfectly conducting spherical earth which is surrounded by a plasma. Numerical results are presented and discussed for various special cases. Author (TAB)

N66-34199# California Inst. of Tech., Pasadena.

SINGLE PULSE RESPONSE OF A PLASMA

Roy W. Gould May 1966 10 p refs

(Contract Nonr-220(50))

(TR-31; AD-634287) CFSTI: HC $1.00/MF $0.50

The conjecture by Hirschfield and Wachtel that a weak pulse of radiation can trigger the emission of a large delayed burst of coherent electron cyclotron radiation is examined critically. The effect is found to exist when the electrons have a single velocity perpendicular to the magnetic field, but disappears in a thermal equilibrium distribution. Author (TAB)

N66-34293# General Electric Co., Philadelphia, Pa. Missile and Space Div.

ELECTRICAL CHARACTERISTICS OF THE LINEAR HALL AND FARADAY GENERATORS AT SMALL HALL PARAMETERS

Bert Zauderer Jun. 1966 38 p refs Submitted for Publication *Its* Tech. Rept.-3

(Contract Nonr-3867(00))

(R66SD33; AD-634098) CFSTI: HC $2.00/MF $0.50

Experiments were performed to determine the electrical characteristics of the linear, segmented electrode, Hall and Faraday MHD generators. The generator working fluid was shock heated xenon at 7000°K gas temperature, one atmosphere pressure, equilibrium conductivity of 850 Mhos/m, and a Hall parameter which ranged in value from 0.7 to 2.5. The study was performed with and without magnetically-induced-ionization effects in the generator. If the electrode voltage losses were included in the data analyses, the Faraday generator load characteristics were in agreement with the theory of Hurwitz, Kilb, and Sutton. If the voltage losses at the Hall current electrodes were included in the data analyses, the Hall generator load characteristics obtained under equilibrium plasma conditions were in agreement with the theory of Dzung.

In the presence of magnetically induced ionization, the open circuit Hall voltage and the Hall load characteristics were on the average 30% and 10% respectively below the theoretically predicted values. The Hall output reduction is attributed to plasma nonuniformities caused by gas dynamic forces, Lorentz forces and non-uniform extra-thermal ionization effects, however, it was not possible to determine from the present experiments which of these three loss mechanisms was dominant. Author (TAB)

N66-34307# Library of Congress, Washington, D. C. Aerospace Technology Div.

APPARATUS AND TECHNIQUES FOR PLASMA DIAGNOSTICS

Stuart G. Hibben *In its* Foreign Sci. Bull., Vol. 2, No. 7 Jul. 1966 p 1-18 refs (See N66-34306 20-34)

Reviewed is Soviet technology in plasma diagnostics. Laboratory apparatus and techniques are reported; emphasis is on microwave probe equipment, and radar probe reflective techniques. Mentioned is a direct approach to plasma analysis by approximating the condition of black-body radiation from the plasma, in which case the radiation (i.e., electron) temperature is independent of frequency and can readily be determined from the radiated power. Improvements in submillimeter and infrared technology leading to increased studies of plasma radiation at such wavelengths is noted. References are listed for measuring corpuscular flux from a plasma or probing with a corpuscular beam. Also included are data on beamed particle probing of a plasma. R.LI.

N66-34444# Columbia Univ., New York. Plasma Lab.

DRIFT WAVE EXCITED ANOMALOUS DIFFUSION IN A FULLY IONIZED MAGNETOPLASMA

B. J. Eastlund, K. Josephy, R. F. Leheny, and T. C. Marshall [1966] 42 p refs

(Grant NSF GK-125)

(Rept.-28)

The transverse diffusion coefficient, D_T, of a fully ionized plasma in a Q-machine was observed to depend on the frequency and amplitude of drift waves. These waves, observed with a floating Langmuir probe and spectrum analyzer, could be impressed on the plasma; (1) by injecting a weak electron beam along the plasma axis, (2) by applying an ac signal of appropriate frequency to a plate at one end of the plasma, (3) by drawing dc current through the plasma or, (4) they were found to occur naturally. D_T was determined from the radial profile of potassium plasma pulses. In all cases, D_T was strongly influenced by the amplitude of the low frequency components of the spectrum, and was observed to be proportional to the rms power of the fluctuations. The impedance of the plasma as a function of the impressed ac signal showed minima at frequencies close to that of the drift instability, where the value of D_T exhibited strong maxima. Author

N66-34468# Aerojet-General Nucleonics, San Ramon, Calif. Research Div.

RESEARCH ON UNSTABLE OSCILLATIONS IN ENERGETIC ARCS Final Technical Report, 1 Mar. 1965-30 Apr. 1966

Carl B. Kretschmer May 1966 49 p refs

(Contract AF 49(638)-1548)

(AN-1512; AFOSR-66-0890; AD-634023) CFSTI: HC $2.00/MF $0.50

Gas-fed hollow-cathode vacuum arcs in argon, nitrogen, hydrogen and helium were studied. These arcs operate in a magnetic field of several kG and have current density approx. 100 A/cm^2, voltage approx. 10^2 V, density approx. 2×10^{14}cm^{-3} electron temperature approx. 1 eV, and ion temperature ranging from 2 eV in hydrogen to 32 eV in argon. Temperatures were determined spectroscopically. The arc column is essentially completely ionized and consists largely of doubly charge ions (except in hydrogen). The current is carried by a small fraction (approx. 2×10^{-2}) of the electrons having temperature 20-50 eV—much higher than the main electron population. These fast electrons control the conductivity at a sufficiently high value to make the longitudinal electric field very small. They acquire energy in passing through the cathode sheath and lose it in coulomb collisions with slow electrons, in ionizing and exciting ions, and in exciting drift waves. In spite of these losses they reach the anode with energies of 20-50 eV. More than half of the input power to the argon arc is radiated in the vacuum ultraviolet. Azimuthally propagating drift waves are present at approx. 35 kc and in the range 150 kc to several Mc. The latter are excited by the fast electrons and heat the ions by cyclotron absorption. Dispersion relations for these waves are presented. Author (TAB)

N66-34535# Illinois Univ., Urbana. Coordinated Science Lab.

PARAMETRIC EFFECTS OF RADIATION ON A PLASMA

E. Atlee Jackson Jun. 1966 40 p refs

(Contract DA-28-043-AMC-00073(E))

(R-298; AD-634274) CFSTI: HC $2.00/MF $0.50

The parametric excitation of the modes of an infinite plasma by intense incident radiation is studied on the basis of the Vlasov equation. It is found that the modes can be driven into unstable oscillations for incident frequencies in the three regions $\omega_0 \simeq \omega_{pe}$, $\omega_{pe} + \omega_i$, and $2\ \omega_{pe}$, where ω_{pe} is the electron plasma frequency, and ω_i is the ion acoustic frequency. In the limit of weak intensities, the features of the two resonances $\omega_0 \simeq \omega_{pe} + \omega_i$ and $2\ \omega_{pe}$ are found to be in substantial agreement with the results of DuBois and Goldman. For larger intensities it is found that the resonance $\omega_0 \simeq \omega_{pe} + \omega_i$ is restricted to frequencies, ω_0, which are not more than 4 ω_{pi} above this value, and have a maximum growth rate of .05 ω_{pe}. The resonance near $\omega_0 \simeq \omega_{pe}$ is found to be dominated by collisional damping if $(\gamma/\omega_{pe}) > 10^{-4}$, and limited to a range of frequencies ω_0 of only $\omega_{pi}/100$. The present results, for large intensities, only partially agree with the results obtained by Silin, who only studied one of the present resonances. These results indicate that the usual harmonic approximation for the plasma is not justified in the study of optical mixing. Author (TAB)

N66-34577*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SUPERCONDUCTING MAGNETIC BOTTLE FOR PLASMA PHYSICS EXPERIMENTS

Willard D. Coles, John C. Fakan, and James C. Laurence Washington, NASA, Aug. 1966 15 p refs

(129-02-05-10-22)

(NASA-TN-D-3595) CFSTI: HC $1.00/MF $0.50 CSCL 20I

A superconducting magnetic bottle consisting of two mirror coils, a central field coil, and a cylindrical cusp field coil was designed and constructed of seven-strand niobium-25-percent-zirconium cable. The configuration was designed to investigate the problems involved in using superconductive materials to produce magnets useful for experiments in plasma physics. Mirror fields as intense as 5 teslas were produced in the bore of the 10-centimeter-inside-diameter coil assembly with a superimposed quadrupole cusp field of 5 to 10 percent of the center field and a mirror ratio of 2. Author

N66-34886# Brown Univ., Providence, R. I. Div. of Engineering.

MODAL SOLUTION OF A POINT SOURCE IN A STRONGLY FOCUSING MEDIUM

Arthur D. Yaghjian and Edward T. Kornhauser Jun. 1966 32 p refs /ts Sci. Rept.-2

(Contract AF 19(628)-5846)

(AFCRL-66-403; AD-635212) CFSTI: HC $2.00/MF $0.50

The ray solution of a point source located in a medium with varying propagation constant given by $k(z)=k_o\sqrt{\operatorname{sech}^2\alpha z-\beta^2}$ exhibits for $\beta=0$ the interesting property of the focusing of all rays at periodic distances. The problem of finding the exact solution for the electromagnetic field reduces to that of finding Green's function to the scalar wave equation. The eigenfunctions for the scalar wave equation consist of a mixed spectrum, i.e. a continuous set of eigenfunctions plus a finite number of discrete eigenfunctions. The mixed spectrum is normalized and shown to form a complete set, in which the Green's function is expanded. Examination of the discrete spectrum in the far field reveals that all the lower order modes add in phase where ray theory predicts focusing. Integral approximations for the continuous spectrum shows that it represents a non-propagating rapidly decaying field, which is negligible compared to the discrete spectrum, except in the region close to the point source. Author

N66-34699*# Stanford Univ., Calif. Inst. for Plasma Research.

ON THE INTERPRETATION OF IONOSPHERIC RESONANCES STIMULATED BY ALOUETTE I

F. W. Crawford, R. S. Harp, and T. D. Mantei May 1966 38 p refs

(Grant NGR-05-020-077)

(NASA-CR-77356; IPR-75) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Plasma ringing phenomena were excited by Alouette I and other ionosphere probes at the local electron plasma frequency, upper hybrid frequency, and gyrofrequency harmonics. It was suggested that this effect is closely linked to the fact that near these frequencies the warm plasma electrostatic waves, which could normally carry the energy away, have near-zero group velocity. The energy consequently remains in the vicinity of the antenna and manifests itself in the ringing. This hypothesis may be verified by studies of the group delay of a wave-packet propagating between two antennas. Theoretical predictions of such delay are presented and were found to agree very closely with laboratory plasma measurements. The success of these studies suggests a powerful new diagnostic technique based on group delay measurement. Its applicability to ionospheric studies is examined, and it is concluded that the method should be readily usable to obtain plasma parameters with high accuracy. The method has the advantage that it is influenced very little by local plasma perturbations produced by vehicle and antennas. Author

N66-34712# Sydney Univ. (Australia). School of Physics.

WILLS PLASMA PHYSICS DEPARTMENT Tenth Monthly Progress Report, 1 Jul.-31 Dec. 1965

[1965] 8 p

(NP-15940; PR-10)

Brief comments on research on plasma sources, J×B ionization front studies, compressional wave studies, giant Alfven waves, microwave interferometry at 2 mm, magneto-Kerr effect, and lasers are included. NSA

N66-34723# Akademiya Nauk SSSR, Novosibirsk. Institut Yadernoi Fiziki.

INVESTIGATION OF DRIFT INSTABILITY IN POTASSIUM PLASMA [ISSLEDOVANIE DREIFOVOI NEUSTOICHIVOSTI V KALIEVOI PLAZME]

N. S. Buchel'nikova 1965 17 p refs In RUSSIAN

(NP-15784)

A plasma was formed by heating potassium vapor to 2000°K on tungsten. The plasma was cylindrical and limited on the ends by the heated tungsten plates. A magnetic field of 400 to 3000 G was directed along the cylinder axis. The plasma density was a maximum on the axis, and decreased with radius. The radius was R=2 cm, and the distance between the end plates was L=36 cm. The plasma was strongly ionized, and was collision-free at densities of 1.0×10^9 to 1×10^{10}cm^{-3}. The direction of electron drift was found from the change in phase shift of signals from two probes. It was found that drift oscillations were excited in a region of frequencies from 1.5–2 up to 70–80 kcps. In this case the state of the plasma was weakly turbulent. The amplitudes of the oscillation in density n and in potential V were measurd. It was found that within 20%, n/n=eV/T. The oscillations were potential. At densities of 1×10^9 to 1×10^{10} cm^{-3}, the value of n/n did not depend on the magnetic field or density. On increasing the density above 7 to 10×10^{10} cm^{-3}, the amplitude (n/n) decreased due to damping of the instability as result of an increase in the number of ion–ion collisions which hace a stabilizing effect. The diffusion coefficient was measured from the plasma flow transverse to the magnetic field. Its value was found to be 10^2cm^2/sec at densities of 1×10^9 to 1×10^{10} cm^{-3}. This value significantly exceeded the classical value of 0.5 for $n=1\times10^9$ and H=1000. The anomalous diffusion was due to drift instability. NSA

N66-34765# Akademiya Nauk SSSR, Novosibirsk. Institut Yadernoi Fiziki.

QUANTUM DEPOLARIZATION OF ELECTRONS IN MAGNETIC FIELD [KVANTOVAYA DEPOLYARIZATSIYA ELEKTRONOV V. MAGNITNOM POLE]

V. N. Baier and Yu. F. Orlov 1965 7 p refs In RUSSIAN

(NP-15783)

High-energy (E=6 Bev) electrons or positrons in a storage ring can be strongly polarized in a time of $\tau_{pol.}=190$ sec with a magnetic field H=8000 gauss. Even though the particle energy can be chosen so as to avoid depolarizing resonances caused by radical and azimuthal constituents of the magnetic field, it is possible to obtain electron depolarization at high energies with small perturbations of the magnetic field. The effect is caused by the fact that the energy jump associated with the quantum character of the radiation contains harmonics that give resonances. If the most dangerous harmonics are eliminated, the depolarization effect will be considerably reduced. Quantum depolarization is investigated under the assumption that the electron trajectory is classical, but that the particle energy undergoes a quantum jump. With a reasonable choice of parameters (particle energy E=6 Bev, H=8000 gauss, R=3000 cm), the analysis indicated that the depolarization time $\tau_{depol.}=25$ sec. Thus, the beam is not polarized, and it would be necessary to take special measures to maintain the polarization. However, it should be noted that the polarization is remarkably stable. NSA

N66-34886# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

MAGNETOHYDRODYNAMIC PROPULSION Scientific Report No. 29

H. Friedel and K. Lackner 5 Dec. 1965 33 p refs

(Contract AF 61(052)-675)

(AFOSR-66-0942; AD-634253) CFSTI: HC $2.00/MF $0.50

The applicability of magnetogasdynamic concepts to the description of the flow in plasma accelerators is studied. Two methods are proposed for the theoretical treatment of steady crossed field and traveling wave accelerators.

Author (TAB)

N66-34895# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF PLASMA BY THE METHOD OF PROBING WITH BEAMS OF FAST PARTICLES

L. I. Krupnik and N. G. Shulika 16 Feb. 1966 21 p refs Transl. into ENGLISH from Predstavlennyy na vi Mezhdunarodnyy Simpozium po Ionizatsionnym Yavlentiyam v Gazakh, Parizh, Iyul', 1963 p 1–25
(FTD-MT-65-101; AD-634808) CFSTI: HC $1.00/MF $0.50

Dense hydrogen plasmoids were investigated by probing them with beams of accelerated neutral and charged hydrogen particles. Investigations were made on the density of the plasmoid; its neutral component; its behavior in a magnetic field; and the radial distribution of plasma density in the plasmoid. Author (TAB)

N66-34900# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STABILITY OF A UNIFORM PLASMA COMPOSED OF STREAMS IN THE ABSENCE OF AN EXTERNAL FIELD
Hiromu Momota Feb. 1966 23 p refs Submitted for Publication
(IPPJ-45; AD-632782) CFSTI: HC $1.00/MF $0.50

By means of the collisionless Boltzmann equation and the Maxwell equations with no external field, it is shown that a plasma composed of streams is necessarily unstable for a transverse oscillation propagating perpendicularly to the streams. The instability is attributed to the bunching of the electric current density, corresponding to the bunching of the charge density in the usual two-stream instability which is accompanied by the excitation of a longitudinal oscillation. When the thermal motion of the particles in a stream is taken into account, the instability can be suppressed due to the thermal diffusion of the bunched current. For a transverse oscillation, a criterion of the stability is obtained. Author (TAB)

N66-34912# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
COLLISION FREQUENCIES AND ENERGY TRANSFER-ELECTRONS
Peter M. Banks 1 May 1966 40 p refs
(Grant Nonr(G)-00009-66)
(AD-634799) CFSTI: HC $2.00/MF $0.50

An investigation has been made of ion collision frequencies and energy transfer for conditions of gaseous thermal nonequilibrium. Following the methods of a development devoted to electron collisions, the problems of ion–neutral and ion–ion elastic collisions have been considered under the assumption of separate Maxwellian velocity distributions. Expressions for the nonequilibrium momentum transfer cross sections, collision frequencies, and energy transfer rates are given for neutral gases on the basis of a polarization potential and for ions on the basis of the coulomb interaction. Next, the problem of ion–neutral resonance charge exchange is introduced in its effect upon collision cross sections and ion energy transfer rates. An analysis is made of gathered laboratory data to arrive at suitable expressions for the resonance charge exchange and momentum transfer cross sections for $H(^+)$, $O(^+)$, $He(^+)$, $N_2(^+)$, and $O_2(^+)$. Using these results, resonance charge exchange and momentum transfer collision frequencies are derived. The resonance ion–neutral energy transfer rates are then compared with expressions used in previous studies of ion temperatures. Author (TAB)

N66-34988# Stanford Univ., Calif. Inst. for Plasma Research.
COMPUTER SIMULATION OF ANOMALOUS PLASMA DIFFUSION AND NUMERICAL SOLUTION OF POISSON'S EQUATION
R. W. Hockney May 1966 204 p refs
(Contracts Nonr-225(83); AT(04-3)-326)
(SUIPR-53; AD-634787) CFSTI: HC $6.00/MF $1.25

The purpose of this research was to study the diffusion of a collisionless plasma across a constant magnetic field by means of a two-dimensional Lagrangian computer model. This model represents the plasma by means of approximately 1000 charged rods and calculates their motion, stepwise in time, as they move according to the laws of Newton and Maxwell. The model is quasi-electrostatic and takes 1.7 sec to perform a time-step on the IBM 7090 computer. The heart of the model is a fast, direct method, utilizing Fourier analysis, for solving Poisson's equation. For simple geometrical configurations, this technique is faster than the best iterative methods. The speed of the Poisson solver is made possible by the development of systematic techniques for performing Fourier analysis over certain numbers of points. These techniques, which reduce computer time by using the symmetries of the sine functions are faster and more accurate than other published algorithms. Results of the investigation of anomalous diffusion were displayed in a 2-minute motion picture, which shows the position of every plasma particle and the shape of the potential surface. The buildup of a 'steady-state'-potential distribution that is unstable can be observed in a sequence of frames. The diffusion, which can all be attributed to the coherent E-field of an unstable wave, is several orders of magnitude greater than that due to binary collisions in a real plasma with the same constants. Classical collisional diffusion between rods in the model is negligible, and the model simulates essentially collective phenomena such as instabilities and "anomalous" diffusion. Author (TAB)

N66-35004# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON SINGULARITIES OF AN ELECTROMAGNETIC FIELD IN AN INHOMOGENEOUS MAGNETOACTIVE PLASMA
V. V. Dolgopolov [1965] 7 p refs Transl. into ENGLISH from Vysokochastotn. Svistva Plazmy, Naukova Dumka (Kiev), 1965 p 89–98

This paper investigates the electric field behavior of a swelling wave near the point of swelling in a magnetoactive plasma for an arbitrary angle between the permanent magnetic field direction and the normal to the surface of the plasma layer in the case of oblique wave incidence on the layer. The solution was found in a broader domain for some particular cases with a wavelength somewhat less than the distance within which the layer parameters change substantially. R.N.A.

N66-35006# Royal Aircraft Establishment, Farnborough (England).
A NOTE ON A POSSIBLE EXPERIMENT ON THE PROPAGATION OF LONGITUDINAL WAVES THROUGH AN IONIZED GAS IN THE PRESENCE OF A MAGNETIC FIELD
E. G. Broadbent Mar. 1961 15 p refs
(RAE-TN-Aero-2742) CFSTI: HC $1.00/MF $0.50

Consideration is given to the production of an ionized gas in conditions suitable for experiments on the propagation through it of sound waves at wave lengths below the mean free path. The conditions suggested to give about the same degree of ionization as exist in the ionosphere are either cesium vapor at 1650°K or potassium vapor at 1900°K in a chamber of about 20 cm length and 10 cm diameter. An axial magnetic field that could be varied up to 5000 gauss would be desirable to check the directional effect of the waves at frequencies below the ion gyro frequency in a low beta plasma. Experimental techniques and chamber material are not discussed in any detail. The vapor pressure is somewhat less than 10^{-4} atmospheres. Author

N66-35020*# AVCO-Everett Research Lab., Everett, Mass.
ON THE EQUILIBRIUM OF ELECTRON CLOUDS IN TOROIDAL MAGNETIC FIELDS

J. D. Daugherty and R. H. Levy May 1966 33 p refs Submitted for Publication
(Contracts NAS8-20310; AF 49(638)-1553)
(NASA-CR-77387; AVCO-Everett Res. Rept.-248) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The self-consistent equilibrium configurations available to low density ($q=\omega_p^2/\omega_c^2<<1$) toroidal electron clouds under the influence of an external magnetic field and the electric fields due to space and image charges are discussed. The equilibria are dynamic rather than static, but steady. ∇B, centrifugal, and other drifts are shown to be unimportant, in contrast to the situation in toroidal neutral plasmas. Typical equilibria are shown in detail, to zero order in q. The construction of equilibria accurate to order q is shown to be possible but is not carried out in detail. Author

N66-35031# National Aeronautical Lab., Bangalore (India).
DESIGN CHARTS FOR NITROGEN PLASMA TUBE ARC HEATERS
T. K. Bose, S. P. Kalra, and S. N. B. Murthy Feb. 1966 102 p refs
(TN-PR-2-66) CFSTI: HC $4.00/MF $0.75

A set of design charts for the preliminary design of a tube arc heater operating with nitrogen gas in the inlet flow regime (a portion of the cold gas always remaining unheated, except for radiation, at the wall of the tube) has been developed with a simplified theory of axi-symmetric flow. As an example of the application of the design charts, the National Aeronautical Laboratory experimental apparatus for producing hot nitrogen gas (maximum temperature at axis being about 12,000°K) is described in some detail; the apparatus will be operated in a specified type of inlet-mode regime. Author

N66-35252# European Atomic Energy Community, Ispra (Italy). Metallurgy and Ceramic Service.
THE PLASMA GUN AND ITS APPLICATIONS [LE CHALUMEAU A PLASMA ET SES APPLICATIONS]
H. Marchandise 1965 242 p refs In FRENCH Prepared jointly with Advanced Technol. Labs.
(Contract AT(04-3)-250)
(EUR-2439.f; TID-22136) CFSTI: HC $6.00/MF $1.25

A review is presented on the main properties of electric arcs and more particularly of the constricted type of arc. Data on plasma properties are also reviewed. A study of the plasma gun itself and the jet of plasma that it produces is presented. Data are given on the influence of several parameters on the electrical characteristics and on the thermal efficiency of a plasma gun. The main parameters examined in detail are: gas flow, nature of the gas, electrode spacing, voltage and current. Results are discussed and correlated with some general data on the constricted arcs. Among the applications described, spraying of metal powders and ceramic materials was given special development, with references to experimental data from work performed in this field. Some applications in high temperature chemistry are quoted together with other uses of the plasma jet, like metal cutting, welding and furnace-heating. Author (NSA)

N66-35259# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.
MEASUREMENT OF ELECTRON TEMPERATURE IN CESIUM LOW-VOLTAGE ARC [IZMERENIE ELEKTRONNOI TEMPERATURY V TSEZIEVOI NIZKOVOL'TNOI DUGE]
Yu. K. Gus'kov, A. I. Kiryushchenko, M. A. Lebedev, and G. G. Morozova 1965 8 p refs In RUSSIAN
(TEI-18)

The electron temperature T_e was determined at a low pressure of cesium vapor (0.1 to 1 torr) with an interelectrode spacing of 6 mm. The electrode temperature was measured with a chromel–aluminum thermocouple. The intensity of the recombination radiation each 0.4 mm was recorded on film in a spectrograph with a linear resolution of 0.2 mm. On assuming a quasineutral plasma with a Maxwellian distribution of electron energies, the electron temperature could be determined from the slope of a plot of the radiation intensity as a function of the frequency of the radiation. With a cathode temperature of 1100°K, an anode temperature of 800°K, a cesium vapor pressure of 0.1 torr the electron temperature T_e at the cathode was a maximum of 4000°K at a distance of about a mean free electron path length ($l_0=6\times10^{-2}$ cm). Then the value of T_e dropped sharply to 2000°K, and an increase in T_e was observed at the anode. The electron temperature was almost constant along the gap. Author (NSA)

N66-35298# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
ADIABATIC INVARIANTS AND THE EQUILIBRIUM OF MAGNETICALLY TRAPPED PARTICLES
R. J. Hastie, J. B. Taylor, and F. A. Haas Mar. 1966 43 p refs Submitted for Publication
(CLM-P-103) CFSTI: HX $2.00/MF $0.50

This paper deals with two topics, firstly with the conditions for plasma equilibrium in an arbitrary magnetic field and their relation to the lowest order particle adiabatic invariants, secondly with the form of the higher order contributions to these adiabatic invariants. In part I the equilibrium conditions are investigated in a systematic way: as the time scale of equilibrium is increased the constraints on the distribution function become more severe until they culminate in the requirement that it be a function of the lowest order adiabatic invariants. In part II it is shown that this discussion of equilibrium leads to a convenient and novel way of generating the adiabatic invariants, not just to lowest order but including higher order contributions, for which a recurrence formula is derived. Part III discusses the effect of electric fields and the extension of the calculations to the dependent magnetic fields, leading to the third adiabatic invariant (the flux invariant). Part IV deals with the case of toroidal magnetic fields possessing magnetic surfaces and the form of longitudinal invariant appropriate in such a field. In the case of small rotational transform a modified line integral for J leads to a convenient description of particle motions in toroidal systems, including the effects of both rotational transform and guiding center drifts. Author

N66-35323*# Rensselaer Polytechnic Inst., Troy, N. Y.
TRANSPORT PHENOMENA IN IONIZED GASES AS AN INITIAL VALUE PROBLEM
D. A. Huchital and E. H. Holt Washington, NASA, Sep. 1966 11 p refs
(Grant NsG-48)
(NASA-CR-559) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Certain transport phenomena in plasmas are discussed in terms of initial value problems. Plasma diffusion is discussed from two points of view. If the moments of the Boltzmann equation are taken there results the macroscopic equations. This approach yields a diffusion equation which differs from the conventional equation based on Fick's law. A second point of view is developed by solving the Boltzmann equation using Fourier and Laplace transform techniques which permit the initial conditions to be inserted into the solution. This latter approach is superior. It is also used to study plasma transport in an applied electric field. In treating the collision operator a Lorentz gas model of the plasma

is chosen. The solution is obtained in terms of odd and even components of the distribution function. The initial condition propagates along a single particle orbit in phase space but the number of particles is depleted at the rate exp (-$\nu t/2$) where ν is the electron collision frequency. Those particles which suffered a collision are deposited in a residue in phase space. An asymptotic formula for the solution for long times was obtained. The collisional residue contains the Maxwell–Boltzmann distribution, a term describing the diffusion in configuration space independent of the electric field and a term describing the heating of the electron gas by the electric field and the resulting diffisuion in velocity space. Author

N66-35339# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE INTERACTION OF CHARGED PARTICLES WITH A TURBULENT PLASMA

I. A. Akhiezer [1965] 6 p refs Transl. into ENGLISH from Vysokochastotn. Svoistva Plazmy, Naukova Dumka (Kiev), 1965 p 139–142

Calculations are presented on the energy lost (or acquired) per unit time by a charged particle moving through a turbulent plasma. The intensity of charged particle interaction with a plasma is determined by the level of the plasma fluctuations. A formula is derived to show the relationship of the energy losses of the particle per unit time, with the correlation of the charge density. An equation is also given to represent the charge density correlation in the acoustic domain when the plasma consists of cold ions and hot electrons moving relative to the ions. The dependence of the change in particle energy on the magnitude and direction of its velocity is established, and it is shown that the turbulence spectra exert no effect on this dependence. M.G.J.

N66-35340# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE THEORY OF NONLINEAR MOTIONS OF A NON-EQUILIBRIUM PLASMA

I. A. Akhiezer [1965] 10 p refs Transl. into ENGLISH from Vysokochast. Svoistva Plazmy, Naukova Dumka (Kiev), 1965 p 142–148

Simple waves in a nonequilibrium plasma consisting of hot electrons and cold ions are studied, based on the kinetic equation and without use of a special model. A system of equations is obtained for the moments introduced in a specific manner of the electron distribution function. This permits establishing the direction of changes in the quantities characterizing the plasma in the sound wave, and tracing the development of finite amplitude perturbations. The electron distribution function changes in a simple wave are traced, and the case of the Maxwellian distribution is considered in detail. The motions of a two-temperature plasma, which occur under uniform compression or expansion, is also considered. M.G.J.

N66-35341# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON HIGH-FREQUENCY HEATING OF A PLASMA

K. N. Stepanov [1965] 21 p refs Transl. into ENGLISH from Vysokochast. Svoistva Plazmy, Naukova Dumka (Kiev), 1965 p 38–59

Collisionless, high frequency methods of plasma heating are surveyed, and these techniques are compared with the ohmic heating method. Details are given on Cerenkov ion heating, Cerenkov heating of electrons by a magnetosonic wave field, ion cyclotron resonance–Alfven wave absorption, and cyclotron absorption of a magnetosonic wave. An example of ohmic plasma heating is described. The findings indicate: (1) When the distortion of the ion distribution function is compensated by collisions, Cerenkov and cyclotron plasma heating by weak fields occur at the same rate as ohmic heating by constant electric fields whose intensity is less than critical. (2) Plasma heating by weak fields up to the thermonuclear temperature takes less time than that required to maintain plasma in a thermonuclear reactor with a positive balance. (3) In heating by fields with subcritical intensities, a high density plasma is more convenient since collisions occur more frequently, the critical values of the field intensity are greater, and the heating time is less. M.G.J.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-34140# Rensselaer Polytechnic Inst., Troy, N. Y.

INVESTIGATION OF TRANSIENT RADIATION DAMAGE IN SEMICONDUCTOR MATERIALS Second Quarterly Progress Report, 1 Jan.–30 Mar. 1966

John C. Corelli, Arthur Robb Frederickson, and James W. Westhead Jun. 1966 25 p refs *Its* Rept.-2

(Contract DA-28-043-AMC-01788(E))

(ECOM-01788-2; AD-634488) CFSTI: HC $1.00/MF $0.50

Transient radiation effects induced in silicon irradiated at 122°K and 300°K by pulses of 48 MeV electrons were studied using the transient response of resistivity and Hall effect voltages as the measuring probes. Results are given for one ohm-cm boron-doped P-type sample. In the case of one ohm-cm silicon the results clearly show the actual buildup of excess electrons produced by ionization during the time the electron pulse is irradiating the sample. Moreover, the shape of the pulse during buildup is independent of temperature so long as the electron beam pulse is kept constant. Dependence of the number of injected excess carriers on the ionization intensity (total integrated electron flux in the pulse) was found to be linear up to excess carrier concentrations of $10^{17}/cm^{-3}$. The lifetime is found to increase linearly with injection implying that the recombination may be dominated by one defect energy level. The significant damage mechenism can be understood by considering only the transient ionization effects, since atomic displacements effects are small and insignificant. Author (TAB)

N66-34183# Navy Electronics Lab., San Diego, Calif.

LOCAL ORDER FOR TERNARY MATERIALS IN A CRYSTAL Research and Development Report, Jun. 1965–Jan. 1966

D. O. Christy 9 Mar. 1966 71 p refs

(NEL-1361; AD-634486) CFSTI: HC $3.00/MF $0.75

The coding technique for describing order in a binary material is extended to describe a ternary substitutional material. The coding is so constructed that in the limit as the third component becomes small, the ternary order parameters approach the Warren–Cowley binary order parameters. Bounding values developed for the various order parameters result from geometrical considerations. The number of each kind of pairs must be non-negative. The Schwarz inequality technique must be applicable to the coding function. A simple scattering problem using the order parameters is presented. An experimental approach to measuring the order parameters is suggested. Author (TAB)

N66-34218# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

RELAXATION PHENOMENA AT HIGH ELECTRIC FIELD ON THE SURFACES OF INDIUM ANTIMONIDE

Howard Huff, Shinji Kawaji, and Harry C. Gatos May 1966 10p refs
(Contract Nonr-3963(05))
(TR-5; AD-634345) CFSTI: HC $1.00/MF $0.50

It was found that high transverse pulsed electric fields applied to indium antimonide surfaces brought about tunneling currents which are extracted through a surface film to the semiconductor bulk. A slow surface state has been located approximately 0.06 eV below the conduction band edge on the (111) A surface of N-InSb. Author (TAB)

N66-34230# Pennsylvania Univ., Philadelphia. Dept. of Physics.
MAGNETO-ACOUSTIC GEOMETRIC RESONANCE STUDY OF BISMUTH UNDER HIGH q_L CONDITION.
Yasuji Sawada and Elias Burstein Jun. 1966 16 p refs
(Contract Nonr-551(51))
(TR-5; AD-634044) CFSTI: HC $1.00/MF $0.50

Magneto-acoustic geometric resonance measurements were carried out to caliper the Fermi surface of Bismuth under the condition of $q_L \approx 100$. Attenuation oscillations due to the electron surface were observed for most orientations of the magnetic field. No clear oscillations were observed for the hole surface. The results for the extremum momenta fit an ellipsoidal geometry for the Fermi surfaces within 5 percent. The ratios of the inverse effective mass tensor components deduced from this experiment using an ellipsoidal model are $\alpha_{11}/\alpha_{22} = 78.1$, $\alpha_{33}/\alpha_{22} = 43.9$, $\alpha_{23}/\alpha_{22} = 5.1$ The tilt angle calculated from these values if 6.7°. Author (TAB)

N66-34233# Sperry Microwave Electronics Co., Clearwater, Fla.
INVESTIGATION OF LARGE SIGNAL MICROWAVE EFFECTS IN FERROELECTRIC MATERIALS Final Report, 1 Jul. 1963-31 Jan. 1966
J. B. Horton and M. R. Donaldson Mar. 1966 133 p refs
(Contract DA-36-039-AMC-03240(E))
(SJ-220-0048-9; AD-634524) CFSTI: HC $4.00/MF $1.00

Theory and measurement techniques for obtaining the dielectric constant and loss tangent for ferroelectric materials at microwave frequencies, and the experimental results using these techniques are included. Results of investigations of methods for processing ceramic (polycrystalline) materials for use at microwave frequencies are reported. Methods of investigating the nonlinear properties of ferroelectric materials biased in the paraelectric region are described, and results obtained using these methods are included. General application of ferroelectric materials for microwave components is discussed: results of the design and evaluation of a 1 GHz passive power limiter are reported. Author (TAB)

N66-34245# Harry Diamond Labs., Washington, D. C.
MEASUREMENTS OF MINORITY-CARRIER LIFETIME IN AN N-TYPE DIFFUSED SKIN
Robert J. Anstead (M.S. Thesis—Catholic Univ. of Am.) Apr. 1966 25 p refs
(TR-1320; AD-633955) CFSTI: HC $1.00/MF $0.50

A modified photoconductivity method was used to measure the minority-carrier lifetime in an n-type, diffused skin. The measurements show the lifetime to be a function of surface conditions. The samples were exposed to gases, treated with etches, and subjected to abrasion. The effect of these treatments on the minority-carrier lifetime is compared with their effect on P-N-P germanium transistors. A short theoretical study of the measuring procedure is also included. Author (TAB)

N66-34251# Army Foreign Science and Technology Center, Washington, D. C.
IS AN AMPLIFIER REALIZABLE WHICH USES THE NEGATIVE MASSES OF SEMICONDUCTOR HOLES ?
L. B. Lytvak-Gors'ka, Ye. M. Gershenzon, and Yu. O. Gurvyich Jun. 1966 12 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 9, no. 9, 1964 p 948-955
(FSTC-TH-23-75-66; TT-66-615-17; AD-634426) CFSTI: HC $1.00/MF $0.50

The quantity of negative effective mass carriers (holes) in Ge and Si is insufficient to realize a negative mass amplifier. A strong electric field acting on Ge at the temperature of liquid nitrogen induces anisotropic conductivity in this material. This anisotropy does not depend on orientation of field in relation to the crystal axes. This indicates that negative mass carriers have slight effect on the anisotropy. Author (TAB)

N66-34263# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.
DETERMINATION OF $\kappa_1(T)$ AND $\kappa_2(T)$ FOR TYPE TWO SUPERCONDUCTORS WITH ARBITRARY IMPURITY CONCENTRATION
Gert Eilenberger May 1966 72 p refs
(Contract Nonr-401(38))
(TR-15; AD-634481) CFSTI: HC $3.00/MF $0.75

Formulas are derived for the constants κ_1 and κ_2 of superconducting alloys for arbitrary temperatures and impurity concentrations. Beginning with Gorkov's equations in matrix-form, the free energy density is calculated using Abrikosov's assumption of a fluxoid lattice. The impurities are treated by the usual averaging technique, retaining only s- and p-scattering, and a special technique is developed to treat exactly the non-vanishing commutator of different components of the gauge invariant derivative. The results contain the already known limiting cases. Intermediate values are obtained by performing machine calculations using the general formulas developed here. It is found that the values of κ_1 and κ_2 drop relatively strongly even for small impurity concentration, and also depend unexpectedly strongly on the ratio of sand p-scattering. The recent result of Cyrot, Caroli and de Gennes is confirmed according to which κ_2 is approximately equal to κ_1 in the dirty limit. Author (TAB)

N66-34288# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering
ULTRASONIC STRESS WAVES IN CADMIUM SULFIDE
Craig Eugene Mahaffy (M.S. Thesis) Mar. 1966 100 p refs
(GSP/PH/66-12; AD-633715) CFSTI: HC $3.00/MF $0.75

The copper and silver doped cadmium sulfide crystals observed in the experiment exhibited essentially the same ultrasonic amplification characteristics as crystals grown from undoped, high-purity, cadmium sulfide powder. The relaxation time of electron trapping is not affected by the presence of the impurity elements copper and silver, at least if the impurity-element concentrations are restricted to those used in this experiment. The calculated value of .3 for the trapping factor in crystal 4 (CdS:Cu-30ppm), as compared to .5 calculated for all other crystals, is a possible indication that the impurity atoms formed trapping centers not present in the other, less heavily doped, crystals. If the restrictions imposed by the linear (small signal) approximation are not violated, the modified amplification equation of Uchida et al. correctly describes the experimentally observed ultrasonic amplification in cadmium sulfide. The disadvantage of the modified equation, in the experimental situation, is that it is possible to obtain apparent agreement between theory and experiment when nonlinear conditions are actually present in the crystal. This situation is made possible by the dependence of the theoretically predicted gain values on the experimentally observed values of maximum and minimum gain. For example, the effects of acoustic gain

saturation can reduce the observed maximum gain which in turn will result in the ratio of theoretically predicted maximum gain to minimum gain being reduced as well. TAB

N66-34470# Picatinny Arsenal, Dover, N. J. Explosives Lab.
THERMOLUMINESCENCE IN POTASSIUM AZIDE
Peter D. Townsend and Paul W. Levy (Brookhaven Natl. Lab.) [1966] 14 p refs Presented at Army Sci. Conf., West Point, N. Y., 14–17 Jun. 1966 Sponsored in part by AEC
(AD-634645) CFSTI: HC $1.00/MF $0.50

The present work has extended the range of thermoluminescence measurements from a lower limit of 77°K to 10°K and has amplified the earlier work to include such effects as the dose dependence of the luminescence signal, measurement of the activation energy of the glow peaks, and the production of additional glow peaks in doped azide powders. There is no simple correlation between the thermoluminescence and the gas evolution, and the detailed study of the glow peaks at various heating rates showed that a comparison of the glow peaks and gas evolution could lead to error if one chose a single heating rate which caused the maxima to occur at a similar temperature. Measurements at several heating rates have shown that the two processes do not proceed at the same time. Author (TAB)

N66-34481# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MEASUREMENT OF THE EXCITED STATE ABSORPTION CROSS SECTION IN RUBY AT 6943Å AND 300°K
Gerald John Robertello (M.S. Thesis) Mar. 1966 98 p refs
(GSP/PH/66-17; AD-633733) CFSTI: HC $3.00/MF $0.75

The excited state absorption cross section from the metastable state in ruby at the ruby laser wavelength and at 300°K was experimentally determined. An indirect method was used, which involved the measurement of the times to laser threshold on four high quality ruby rods. A second experiment was then performed to measure the chromium ion population remaining in the ground state at each of these times. The ground state population was obtained by measuring the increase in intensity of 4100Å probe light transmitted through the pumped ruby sample. An upper limit on the value for the cross section was obtained which is in agreement with that obtained by Kiang et. al. of $0.3\times10^{-20}cm^2$. However, the conclusion was reached that thermally induced scattering had a small influencing effect, which reduced the final result to an average value of $0.17\pm.06\times10^{-20}cm^2$ for the four ruby samples.
Author (TAB)

N66-34484# Martin Co., Orlando, Fla. Materials Research Lab.
INTERPRETATION OF ELECTRON DIFFRACTION PATTERNS FROM THIN PLATELETS Technical Report No. 15
G. Thomas, W. L. Bell, and H. M. Otte (Calif. Univ., Berkeley) Dec. 1965 35 p refs Submitted for Publication Prepared in cooperation with Calif. Univ., Berkeley
(Contract Nonr-3706(00))
(OR-8327; AD-634238) CFSTI: HC $2.00/MF $0.50

Electron diffraction patterns from foils containing planar defects, e.g., precipitates or stacking faults, are considered in terms of relrods normal to the plane of the defect, and/or normal to the specimen surface. The patterns can be regarded as consisting of streaked reciprocal lattices superimposed on the matrix lattice. In the materials examined, faulting did not reproduce any detectable physical shift of allowed reflections. The observations indicate that faulting is regular rather than random. Stacking faults and HCP precipitates in FCC crystals cannot as a rule be distinguished in the early stages of formation of the precipitate. A complete analysis of the spot pattern from foils containing planar defects generally requires an accurate determination of the crystal orientation. For this purpose Kikuchi patterns provide sufficient accuracy and an assessment of this is made. Author (TAB)

N66-34522# Franklin Inst., Philadelphia, Pa. Research Labs.
STUDY OF TRANSPORT PROPERTIES OF REFRACTORY SEMICONDUCTING COMPOUNDS Final Report
F. J. Donahoe and H. Conrad Apr. 1965 43 p refs
(Contract NObs-86800)
(F-B1961; AD-634528) CFSTI: HC $2.00/MF $0.50

The original scope and objective of the program was a theoretical and experimental study of the transport properties of refractory semiconducting compounds which might offer promise as thermoelectric generator materials at fairly high temperatures (up to at least 50°C). The report, consists of: (1) a detailed treatment of the phenomenological theory of various galvano-thermomagnetic effects in crystalline media (including an extensive compilation of the forms of the various pertinent tensors for the thirty-two crystal classes); (2) a brief and qualitative discussion of the electronic structure of $Ma_{2-x}B_x$-type compounds (M=transition metal, A and B are similar elements from the same column of the periodic table); (3) a description of the experimental work carried out on this project, including a summary of the room-temperature measurements of thermoelectric power and electrical conductivity for the systems $MoSi_{2-x}Ge_xCrSi_2$. Author (TAB)

N66-34539# Laboratory for Electronics, Inc., Boston, Mass.
RESEARCH IN FERROMAGNETICS Annual Report, Sep.1, 1962–Aug. 31, 1964
[1964] 74 p refs
(Contract Nonr-2678(00))
(AR-570-A5; AD-634539) CFSTI: HC $3.00/MF $0.75

The magnetization distribution is calculated for a Neel wall finite in thickness but infinite in the other two dimensions. The variational technique yields a solution in terms of elliptic functions that is different from, but a good approximation of, other models based on finite film thickness. The charge density is calculated as a beginning toward accurately determining the interaction field of two Neel walls, each of which in one of a pair of close-spaced films. The results of a study of edge effects in tapered edge films are reported and the methods used to produce these films are described. Experimental evidence is presented which verifies the presence of the theoretically predicted magnetization curling configuration. The tapered edge curling theory is further supported by the absence of the higher energy closure domain configuration. Studies of domain wall properties and interaction in double-layer films are reported. An apparent preference for the formation of Neel type walls has been observed in the double layer films. Experimental evidence is given and energy calculations are presented for configurations of Bloch wall and Neel wall interactions with a neighboring film. The lowering of wall energies and a transition to wall structures of the Neel type are verified in terms of the magnetostatic interaction between a wall in one film and the magnetic material of a superimposed layer. Author (TAB)

N66-34582# Ion Physics Corp., Burlington, Mass.
HIGH ENERGY ION IMPLANTATION OF MATERIALS Scientific Report No. 1, Dec. 1964–30 Apr. 1966
C. M. Kellett, W. J. King, F. A. Leith et al May 1966 110 p refs
(Contract AF 19(628)-4970)
(AFCRL-66-387; AD-635267) CFSTI: HC $4.00/MF $0.75

The report describes investigations conducted on the implantation of high energy (>50 kev) dopant ions into semiconductors for the formation of controlled doped layers. Investigations were conducted with B and P ions for p- and n-type

layers in Si, SiC and diamond, and Zn and S for p- and n-type layers in GaAs, respectively. Extensive theoretical and experimental work was performed in range–energy relationships in silicon to provide a firm foundation for device work. Results of these investigations were used in the fabrication of active devices, particularly a form of unipolar transistor which lends itself to implantation processing. Successful fabrication was demonstrated and high frequency types are currently being developed. Implanted doped layers were formed in GaAs, SiC and diamond with diode formation demonstrated in GaAs and diamond. Preliminary results indicate that ion implantation may be the best method for handling such materials. Author (TAB)

N66-34570# Library of Congress, Washington, D. C. Aerospace Technology Div.

GROWING YTTRIUM-ALUMINUM GARNET CRYSTALS

John Kourilo *In its* Foreign Sci. Bull., Vol. 2, No. 8 Aug. 1966 p 21–25 refs (See N66-34566 20-34)

Soviet achievements during the period 1963–1965 in growing yttrium–aluminum garnet crystals have been reviewed. Different trends were noted in the development of the growth technique from fluxed melts. Major progress was achieved by adding boron oxide to the flux. As a result of this improvement, larger YAG single crystals having an estimated linear dimension of about 2 cm were obtained. Some progress was made in defining the criteria for the growth of quality crystals, although conflicting conclusions were reached by two different teams of Soviet scientists. A comparison was made between Soviet and Western research data. Author

N66-34630*# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.

STUDY OF LITHIUM MOBILITY IN IRRADIATED SILICON

Walter A. Hackler and Chihiro Kikuchi (Ph.D. Thesis) Jul. 1966 106 p refs *Its* Rept.-04381-8-T

(Grant NsG-115-61)

(NASA-CR-77303) CFSTI: HC $4.00/MF $0.75 CSCL 20L

The effect of fast neutron and electron induced defects on the diffusion properties of lithium in silicon is determined experimentally by irradiating lithium diffused diodes and subsequently applying a reverse bias to the junction at a constant temperature. Experimental results show that fast neutron and 0.9 MeV electron induced vacancies provide sites for the precipitation of lithium. Moreover, the lithium vacancy precipitate behaves like a solute in equilibrium ions and ionized vacancies. The analysis of the lithium vacancy precipitate in this fashion is analogous to the analysis of slightly soluble salts in water. It also was shown that the motion of lithium in silicon was not affected by slow neutron irradiation. Author

N66-34631*# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.

STUDY OF ELECTRON–PHONON INTERACTION IN III-V SEMICONDUCTORS Final Summary Report, Jan. 15, 1965–May 31, 1966

Joseph Martin Jun. 1966 95 p refs

(Contract NAS8-20012)

(NASA-CR-77302) CFSTI: HC $3.00/MF $0.75 CSCL 20L

The study of electron–phonon interactions in semiconductors was initiated with an evaluation of several known transducer techniques for generating microwave phonons. Piezoelectric excitation was chosen and some tourmaline and quartz crystals were examined for use as transducers at 9.3 Gc/sec. A large variability was observed from one crystal to another in transduction efficiency at 4.2°K. The temperature dependence of microwave phonon attenuation was measured in quartz and in green and black tourmaline. The quartz measurements covered a very wide dynamic range and were very consistent from one crystal to another. The attenuation in tourmaline was quite different in its temperature dependence from quartz and other crystals. It exhibited a very fast change of slope with increase in temperature but could not be compared to existing theories since necessary auxiliary data is not available for tourmaline. Quartz crystals were used as transducers to generate microwave phonons in InSb semiconductor crystals. Dislocation damping was found to be a strong source of phonon attenuation in boat-grown InSb crystals. Author

N66-34695*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

ENERGY TRANSFER THROUGH EVACUATED NONMETALLIC MATERIALS

David W. Tarbell Jun. 1966 37 p refs

(Contract NAS8-20166)

(NASA-CR-77390; R-199) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Three methods are presented for calculating the spectral absorption coefficient for nonmetallic crystalline solids, and a method for calculating the thermal conductivity of a cubic close-packed array of solid spheres is presented. The three methods in the former are based on a classical, free-ion model, a classical harmonic oscillator model, and a quantum-mechanical harmonic oscillator model. The conductivity calculation is based on the simple addition of conductances in series and parallel. Author

N66-34716# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).

SURFACE TOPOGRAPHY OF ION-BOMBARDED SODIUM CHLORIDE CRYSTALS

V. Marinkovic and B. Navinsek Jul. 1963 5 p refs Presented at the 3d European Regional Conf. on Electron Microscopy, Prague, Aug.–Sep. 1964

(NIJS-R-433; CONF-806-3)

Observations were made on carbon replicas of NaCl single crystals which were bombarded by 2–4 keV argon ions at 50 to 300 $\mu amp/cm^2$. The surface changes at current densities less than and greater than 150 $\mu amp/cm^2$ are described, and mechanisms for the spike formation are discussed. NSA

N66-34722# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi Eksperimental'noi Fiziki.

ON THE COHERENT COULOMBIC EXCITATION OF NUCLEI PASSING THROUGH CRYSTALS [O KOGERENTNOI VOZVUKHDENII YADER, PROLETAYUSHCHIKH CHEREZ KRISTALL]

V. V. Okorokov 1965 12 p refs In RUSSIAN; ENGLISH summary *Its* Rept.-357

(NP-15791)

The qualitiative considerations are presented discussing the existence of the effect of the coherent Coulombic excitation of nuclei passing through a crystal. Author (NSA)

N66-34733# Brookhaven National Lab., Upton, N. Y.

DISTRIBUTION OF MAGNETIC MOMENT DENSITY IN Tb

O. Steinsvoll, G. Shirane, R. Nathans, H. A. Alperin, and S. J. Pickart [1963] 11 p refs Presented at 5th Rare Earth Res. Conf., Ames, Iowa

(Contract AT(30-2)-GEN-16)

(BNL-9244; CONF-650804-1) CFSTI: HC $1.00/MF $0.50

The magnetic form factor of metallic terbium was measured at 4.2°K by scattering of polarized neutrons with wavelength $\lambda = 0.8$Å from single crystal samples. Using a split

coil superconducting magnet giving a field of 40K Oe across the crystal, it was possible to magnetize the samples close to saturation along both the a- and the b-directions, the latter being the direction of easy magnetization. The over-all agreement with theoretical calculations for the Tb^{3+} ion form factor is satisfactory. The experimental points were found to lie on a smooth curve which is consistent with the theoretical prediction that the terbium magnetic moment density has a disc-shaped distribution normal to the resultant moment direction. Author (NSA)

N66-34738# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

INDEX—A COMPUTER PROGRAM FOR INDEXING X-RAY DIFFRACTION PATTERNS

J. B. Goebel and A. S. Wilson Jan. 1965 95 p

(Contract AT(45-1)-1830)

(BNWL-22) CFSTI: HC $3.00/MF $0.75

Input data for this program are the 2θ reflections where θ is the Bragg angle as measured by a diffractometer from powdered crystalline samples. Additional data that may be supplied at the user's discretion are the X-ray wavelengths, a possible error value, empirical gram formula weight and observed density. The program indexes the set of reflections on the basis of the cubic, hexagonal, tetragonal, and orthorhombic systems in that order. All lattice constants are calculated by an iterative least squares procedure. The printed output includes the crystal system, the lattice constants and their standard deviations, the wavelengths used, observed and calculated $\sin^2\theta$ values, and the difference between these latter two. An error term, E, is also printed as well as the number of formula units per unit cell in some cases. The value of E, the size of the lattice constants and their standard deviations, indicate to the crystallographer the validity of the indexing. The Miller indices are printed in the form $h^2+k^2+l^2$ in the cubic case, h^2+hk+k^2 and l^2 in the hexagonal case, h^2+k^2 and l^2 in the tetragonal case, and h^2, k^2, and l^2 in the orthorhombic case. Author (NSA)

N66-34763# Lyon Univ. (France). Faculte des Sciences.

CONTRIBUTION TO THE STUDY OF GENERATION-RECOMBINATION NOISE IN A SURFACE-BARRIER NUCLEAR RADIATION DETECTOR [CONTRIBUTION A L'ETUDE DU BRUIT DE GENERATION-RECOMBINATION DANS UN DETECTEUR DE RAYONNEMENTS NUCLEAIRES A BARRIERE DE SURFACE]

Jacques Sau (Ph.D. Thesis) 11 May 1965 60 p refs In FRENCH

(NP-15172)

The noise of Si surface-barrier detector (the distribution according to the frequency of the mean power and the Fourier transformation of this distribution called the autocorrelation function) was measured. A theoretical model was constructed to interpret the results obtained. The formation of a potential barrier at the surface of a semi-conductor is first described. Various characteristics of time-dependent functions are reviewed. The results are given and interpreted using a model based on the generation and disappearance of charge carriers intervening in the electric conduction. NSA

N66-34825# Institute of Modern Languages, Inc., Washington, D.C.

CONCERNING THE POSSIBILITY OF THERMAL SUPERCONDUCTIVITY IN SEMICONDUCTORS [O VOSMOZGNOSTI SVERCHTEPLOPROVODNOSTI V POLUPROVODNICACH]

A. N. Kozlov and L. A. Maksimov Ft. Belvoir, Va., Army Engr. Res. and Develop. Lab., May 1966 9 p refs Transl. into ENGLISH from Eksperim. Fiz. (Moscow), v. 50, no. 1, 1966 p 131–134

(Contract DA-44-009-AMC-1563(T))

(ERDL-T-1842-66; TT-66-63177; AD-633412) CFSTI: HC $1.00/MF $0.50

The possibility of the existence of an undamped energy flux in a two-band system with pairing is demonstrated. The Landau criterion is proven for a superfluidity in the case of crystal periodicity. The superfluid motion is stable with respect to transfer process and scattering on impurities. Author (TAB)

N66-34889# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanics

DYNAMICAL ASPECTS OF THE DEFORMATION OF A 6-CONSTANT CUBIC CRYSTAL

V. X. Kunukkasseril and W. H. Hoppmann, II Jun. 1966 42 p refs

(Contract DA-30-069-AMC-589(R))

(AD-634923) CFSTI: HC $2.00/MF $0.50

The displacement equations of motion for a 6-constant centrosymmetric cubic crystalline material are developed. Also, the determinantal equations for velocities of plane elastic waves are developed. Previously determined elastic constants are used to calculate the phase velocities in various directions of a cubic crystal. Normal mode vibrations of cubes and infinite prisms are theoretically considered. Dilatational modes of these bodies are determined and they demonstrate that there are no couple-stress effects in these cases. Normal mode shapes and frequencies for the equivoluminal modes are obtained but without consideration of couple-stresses. Free vibration experiments were conducted on a two-dimensional model which was considered as a slice of an infinite prism and on a three-dimensional cubic model. Experimentally determined frequencies and mode shapes are studied in terms of the theoretical results. Author (TAB)

N66-34918# Columbia Univ., New York. Dept. of Physics.

RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report No. 13, Nov. 1, 1965–Apr. 30, 1966

Robert Novick 30 Apr. 1966 101 p refs

(Contract DA-28-043-AMC-00099(E))

(CU-4-66-AMC-00099(E); AD-635373) CFSTI: HC $3.00/MF $0.75

The magnetic resonance technique was applied to observe the radio-frequency Zeeman transition lines of metastable autoionizing states in potassium. Field sweeps made at different frequencies ranging from 10 Mc/sec to 40 Mc/sec showed a linear increase in transition field values as expected for low-field Zeeman transitions. The G_F values deduced from the transition lines indicate the existence of two metastable excited states, the $4F^{5/2}$ and $4D^{7/2}$ states. Earlier resonant self-broadening data for the $(6s^26p7s)^3P_1^\circ$ state of lead was corrected for temperature variations over the surface of the cell. The differential stark shift of the $M_j = \pm 3/2$ and $M_j = \pm 1/2$ sub-levels of the $7^2P_{3/2}$ state of cesium was measured by crossing the HFS levels in a pure electric field. The value obtained is $\alpha/H = 1.07 - 7 \pm 0.043$ Mc/sec)/SQ (KV/CM). A series of measurements of microwave absorption in mixtures of water vapor and nitrogen were made. Absorption was measured at 9260 Mc/sec at temperatures from 120°C to 200°C and at pressures up to 130 atmospheres. Water vapor content ranged from 0.3% to 1.5%. Author (TAB)

N66-34921# American Meteorological Society, Boston, Mass.
CRYSTAL LATTICE DEFECTS AND X-RAY SCATTERING [DEFEKTY KRISTALLICHESKOI RESHETKI I RASSEIANIE RENTGENOVSKIKH LUCHEI]
V. M. Danilenko and L. V. Tikhonov Bedford, Mass., AFCRL, Apr. 1966 106 p refs Transl. into ENGLISH from Sb. Nachn. Rabot Inst. Metallofiz., Akad. Nauk Ukr. SSR, no. 15, 1962 p 3–79
(Contract AF 19(628)-3880)
(T-R-547; AD-635407) CFSTI: HC $4.00/MF $0.75

The paper attempts to classify a number of new results in the investigation of the microscopic structure of real crystals and also to illuminate certain problems related to the scattering of X-rays in crystals with defects. Author (TAB)

N66-34983# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
THERMOLUMINESCENCE OF SEMICONDUCTING DIAMONDS Scientific Report No. 5
A. Halperin (Hebrew Univ.) and R. Chen Jan. 1966 26 p refs
(Contract AF 61(052)-759)
(SR-5; AFCRL-66-385; AD-635044) CFSTI: HC $1.00/MF $0.50

The thermoluminescence (TL) of semiconducting diamonds was found to be composed of blue-emitting (at 150 and 260°K) and red-emitting peaks (at 175 and 285° K). The red peaks could be excited by light of wavelengths up to about 650 mμ (1.8 ev). The blue ones by light up to about 420 mμ (3 ev). The intensity of the red peaks and of the 150° K blue peak was found to increase linearly with the dose of excitation. The same was found for the 260°K blue peak on excitation at the absorption edge (225mμ 5.5 ev). Excitation of this peak at 260–400mμ was found to be superlinear; the peak increased under suitable conditions with the third power of the dose of excitation. Other measurements included the thermal activation energies, the optical bleaching of the glow peaks, and the decay of phosphorescence after excitation at 77° K. A tentative model for the energy levels involved in the process of excitation and emission of the TL is presented to account for the observations. A multiple-stage excitation is proposed to explain the superlinearity. Author (TAB)

N66-34974# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.
THIN FILMS FORMED BY ELECTROCHEMICAL REACTIONS Quarterly Report No. 9, 1 Dec. 1965–28 Feb. 1966
Michael J. F. Gaze Jul. 1966 38 p refs
(Contract DA-36-039-AMC-02324(E))
(TI-03-66-42; ECOM-02324-9; AD-635386) CFSTI: HC $2.00/MF $0.50

This report summarizes the work performed to develop techniques for fabricating thin conductive, resistive and dielectric films by complete or partial oxidation of a suitable metallic film deposited in predetermined patterns and sequences. Gold-tantalum alloys have been reactively sputtered successfully, using separate cathodes at different potentials for each metal. Sample gold-doped tantalum resistors from ideal slices were evaluated for temperature coefficient and power dissipation, and life tests were begun to evaluate the merits of the material. The resistors produced are characterized by temperature coefficient of resistance (TCR) values of less than 100 PPM/°C, and extremely high power dissipation of the order of 1 to 5 watts/square inch. The resistors are readily etched, and sheet resistances up to 300 ohms/square are possible. No additional work was done to improve the deposition process. The advantage of an improved TCR does not justify additional effort since a similar or better TCR may be achieved using nichrome resistors of the same ohm/square value. Development of the sputtering system has required additional time to correct several design and/or manufacturing faults revealed during system test. Author (TAB)

N66-34983# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
CALCULATION OF THE PHYSICAL PROPERTIES OF DEFECTS IN CRYSTALS BY APPROXIMATE SELF-CONSISTENT-FIELD METHODS
Emmett B. Moore, Jr. May 1966 12 p refs
(DI-82-0536; AD-634879) CFSTI: HC $1.50/MF $0.50

The rigorous Roothaan–Hartree–Fock linear-combination-of-atomic-orbitals self-consistent-field (RHF-LCAO-SCF) method of calculating the physical properties of small molecules may be extended by the use of suitable approximations and group theory to molecules which may be regarded as small regions of a crystal containing a defect. An outline is given of the rigorous RHF-LCAO-SCF method, the relation between this method and the simpler extended-Hukel-theory (EHT) which has previously been used to calculate some of the properties of defects in graphite is shown, and it is demonstrated how the RHF-LCAO-SCF method may be approximated to permit calculations of the physical properties of defects in crystals. This approximation of the SCF method has the advantage of being applicable to large molecules (or regions in a crystal) while being much more rigorous than the EHT method and nearly as rigorous as the parent SCF method. Author (TAB)

N66-34993# Parke Mathematical Labs., Inc., Carlisle, Mass.
ATOMIC CASCADE MODELS Scientific Report No. 6
Charles H. Sherman and Nan E. Gordon Feb. 1966 32 p refs *Its* Rept.-2419-SR-6
(Contract AF 19(628)-2419)
(AFCRL-66-164; AD-631278) CFSTI: HC $2.00/MF $0.50

A model for cascades of atomic displacements was developed which is basically the same as earlier models but more general in its treatment of replacement collisions and energy lost to other lattice atoms when an atom is displaced. Simple analytical expressions were obtained for the average number of displacements produced per primary which are sufficiently accurate considering the uncertainties in the basic assumptions. Various specific cases of the model are illustrated numerically and discussed briefly relative to the possibility of using electron irradiation data to determine some of the parameters in the model. Author (TAB)

N66-35066# Rome Univ. (Italy).
EXPERIMENTAL VERIFICATION OF THE THEORETICAL BEHAVIOUR OF SOME FERRITE STRUCTURES Interim Scientific Report No. 3
Giorgio Gerosa and Cesare Maria Ottavi 22 Feb. 1966 7 p refs
(Contract AF 61(052)-807)
(AFCRL-66-390; AD-634974) CFSTI: HC $1.00/MF $0.50

The theoretical behaviour of some microwave ferrite structures has been experimentally verified by detecting the thermal rise produced by the dissipated r.f. power at certain characteristic regions. Author (TAB)

N66-35068# Northeastern Univ., Boston, Mass.
INVESTIGATION OF SOLID STATE DEVICES AND MATERIALS Scientific Report No. 1
Basil L. Cochrun, ed. 1 Feb. 1966 34 p refs
(Contract AF 19(628)-4759)
(AFCRL-66-368; AD-635287) CFSTI: HC $2.00/MF $0.50

Procedures and techniques were developed for the purpose of evaluating new semiconductor active devices, the characteristics of interest are noise, gain, frequency limits of operation

and temperature stability, theoretical and experimental results indicate that the potential discontinuity associated with metal-semiconductor injuctions is dependent upon interface contaminations and surface state effects. A study of materials and fabrication techniques led to more efficient diode lasers. A theoretical explanation was derived for the fine structure of the far-field radiation pattern exhibited by GaAs diodes.

Author (TAB)

N66-35071# Duke Univ., Durham, N. C. Coll. of Engineering.
THE USE OF ANISOTROPIC DIELECTRIC MATERIALS FOR OBTAINING MUTUAL CAPACITANCE Final Report, Jun. 1964-Jun. 1966
Theo C. Pilkington and Robert B. Roe 1 Jun. 1966 69 p refs *Its* Rept.-5115.2
(Grant DA-ARO(D)-31-124-G581)
(AROD-5115-2; AD-635313) CFSTI: HC $3.00/MF $0.75

A generalized theoretical analysis of the anisotropy transformer and similar devices is developed. A transform-analog technique for the determination of optimum physical configurations for realization of mutual capacitance and voltage gain and for the determination of equivalent-curciut parameters is employed. The open-circuit voltage gain of the anisotropy transformer is shown to have an upper limit of unity under linear operation conditions and this demonstration is extended to include the general class of such devices. Since a linear-mode greater than unity is impossible, the non-linear properties of multi-terminal dielectric materials (specifically Rochelle salt) and their application as nonlinear elements in dielectric amplifier configurations is investigated. The use of Rochelle salt as a nonlinear element proves to be impractical and feasibility of nonlinear anisotropic coupling techniques in other oriented ferroelectric crystals is found to depend on poorly understood aspects of the macroscopic consequences of the mechanism of polarization reversal. Author (TAB)

N66-35075# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ULTRAVIOLET REFLECTIVITY STUDIES OF CDS:Se SINGLE CRYSTAL SOLID SOLUTIONS
Lee Morgan Gutheinz (M.S. Thesis) Jun. 1966 106 p ref
(GSP/PH/66-8; AD-633645) CFSTI: HC $4.00/MF $0.75

The reflection spectra of CdS:CdSe solid solution alloys have been measured at room temperature for photon energies in the range 4.0–10.0 ev. The shift in energy of several direct interband transitions (E_0, E'_0, E_1, E_2) with varying cation composition has been observed. The structure is interpreted in terms of an analogous zincblende model, which has been shown to differ from the Wurtzite in the (0, 0, 1) direction in the folded zone scheme of Birman only by the omission of a small trigonal field perturbation. The observed monotnically increasing variation in E_0 is in good agreement with that reported by Handelman and Kaiser. The variation in the transitions is qualitatively interpreted as resulting from an effective lattice parameter dilation which occurs in the alloying process. This dilation is shown to give rise to a potential of deformation which has a perturbing effect on the band edges.

Author (TAB)

N66-35076# Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS Quarterly Report, Jan.-Mar. 1966
R. A. Buchanan, M. A. Butler, C. F. Cook, D. E. Mc Carthy, I. E. Rainwater et al 1 Jun. 1966 44 p refs
(NAVWEPS-8852; AD-635193) CFSTI: HC $1.50/MF $0.50

Five papers are presented on work performed under the foundational research program: dimensionally dependent plasma resonance absorption of InSb in a microwave field; spectra of Pr^{+3} in LaF_3 and PrF_3 from 25 to 75 cm; transmittance and reflectance of infrared optical materials from 2 to 50 microns; tunneling currents across a barrier between thin superconducting films; VLF transmitting dipole. Author (TAB)

N66-35078# Naval Ordnance Lab., Corona, Calif.
BIBLIOGRAPHY ON THE HALL EFFECT THEORY, DESIGN, AND APPLICATIONS, SUPPLEMENT 2
W. R. Turnbull 1 Jun. 1966 33 p refs
(NOLC-659; AD-635197) CFSTI: HC $3.00/MF $0.50

This supplement continues the international survey of unclassified scientific papers and reports on research and development of the Hall effect, and on electronic devices based on the Hall effect to 1 April 1966. The basic document was NAVWEPS report 7233 (AD-283 808); Supplement 1 was NAVWEPS Report 8168 (AD-420 105). Author (TAB)

N66-35107# Rio Grande do Sul Univ., Porto Alegre (Brazil).
APPLICATION OF GAMMA-GAMMA ANGULAR CORRELATION TO THE STUDY OF INTERACTIONS BETWEEN NUCLEI AND THE ENVIRONMENT IN WHICH THEY ARE EMBEDDED Final Report, May 1965–May 1966
Fernando C. Zawislak May 1966 15 p refs
(Grant DA-ARO-49-092-65-G72)
(Rept.-4; AD-635306) CFSTI: HC $1.00/MF $0.50

A series of experiments using an integral gamma ray angular correlation apparatus was made, these include angular correlation measurements in ^{99}Tc and ^{59}Co, and g-factor measurements for an excited state in ^{115}In. A conversion electron gamma ray angular correlation apparatus previously constructed was further developed and exploited. It has proved to be a powerful tool for the study of nuclear properties. Studies are in progress for various cascades in the nuclei ^{207}Pb and ^{160}Dy. Studies were also made of internal electric fields in various compounds of hafnium and in the study of internal magnetic fields acting on nuclei of diamagnetic atoms in solid solutions of ferromagnetic hosts. Construction has commenced on a Massbauer effect apparatus. TAB

N66-35125# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
DYNAMIC OPTICAL PROPERTIES OF LASER MATERIALS Final Technical Summary Report
J. W. Carson and L. G. Komai 31 May 1966 42 p refs
(Contract Nonr-4878(00); ARPA Order 306; Proj Defender)
(P66-134; HAC-A5858; AD-634849) CFSTI: HC $2.00/MF $0.50

Dynamic optical distortions were studied in high quality ruby rods (0.05 percent Cr_2O_3). Radial temperature profiles, determined by non-resonant interferometric techniques, were level to about 5 percent. Radial gain profiles showed variations of 5 percent to 20 percent, depending on the pump energy. A plane polariscope was used to determine the effects of stress birefringence during the pump period. No significant depolarization was observed in ruby during the main part of the pump period, but large birefringence effects were seen in Nd:glass. Thermal changes in length and refractive index were found to be the main source of dynamic optical distortions in ruby. The net effect of these distortions can be made small by use of properly designed cavities.

Author (TAB)

N66-35148# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
DETERMINATION OF INTERATOMIC DISTANCES FROM X-RAY ABSORPTION FINE STRUCTURE
Farrel W. Lytle Apr. 1966 30 p refs Presented at the Ann. Conf. on Appl. of X-ray analysis, Denver, 27 Aug. 1965
(DI-82-0524; AD-634874) CFSTI: HC $1.50/MF $0.50

A particle-in-a-box approximation to the problem of X-ray absorption fine structure has been successful in predicting many features of the effect. The theory successfully accounts for the extended fine structure observed on any X-ray absorption edge in crystalline and amorphous solids, liquids and gases. A simple data analysis technique was developed by which the absorption fine structure can be 'indexed' and atomic distances calculated. Examples are given for crystalline, amorphous, and gaseous materials. Author (TAB)

N66-35158# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.

OPTICAL AND ELECTRICAL PROPERTIES OF CRYSTALS Final Scientific Report

Robert Englman 30 Nov. 1965 6 p

(Contract AF 61(052)-806)

(AFCRL-66-387; AD-635135) CFSTI: HC $1.00/MF $0.50

A summary is given of studies involving covalency effects in trigonal distortion, the transition operator for spin-forbidden transitions and the intensity calculations for absorption bands in tetrahedral symmetry. Author (TAB)

N66-35161# Durham Univ. (England). Dept. of Applied Physics.

RESEARCH ON CADMIUM SULPHIDE RU 15-2 Annual Report, 1964-1965

J. Woods Nov. 1965 20 p refs

(Contract CP/1339/63)

Work is now proceeding on growth of large CdS single crystals in vacuum which promises to yield samples with better crystalline perfection. The work on one and two carrier s.c.l. currents in thin platelets of CdS has continued. At 77°K and under two carrier conditions green electro-luminescence is emitted. Negative resistance current-voltage characteristics are obtained and devices can be switched from a low current state to a high current, light emitting state by irradiation with light with a wavelength of 6000Å. The shapes of the current and light pulses indicate that the effect of the light is to fill hole traps and produce a state in which the hole lifetime is high. Thermally stimulated current measurements on cadmium rich and sulfur rich samples indicate that traps at 0.05 or 0.07 eV, 0.41, 0.63 and 0.83 eV are involved in photo-chemical changes. The situation is complicated by the possibility that some of these traps may be surrounded by repulsive barriers for electrons which prevent them being filled at low temperatures. Attempts are being made to correlate changes in the trapping spectrum with changes produced by the same optical and thermal treatments in the infra-red luminescence. The spectral distribution of the visible luminescence excited at 77°K is also being studied. Author

N66-35189# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.

ON THE SUSCEPTIBILITY OF LIQUID GADOLINIUM

R. M. Xavier, X. A. da Silva, and W. Baltensperger 1965 12 p refs Submitted for Publication *Its* Notas de Fisica Vol. 11, No. 18

CFSTI: HC $1.00/MF $0.50

The effects of a liquid structure and of a short mean free path are evaluated. A distribution function is constructed with the assumption that two elements with the same crystal structure at high temperature have similar distribution functions in the liquid state. The results show that at high temperatures in both solid and liquid state the short mean free path drastically decreases the paramagnetic Curie temperature, which is however larger in the liquid state. N.E.N.

N66-35190# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.

ON THE ORIGIN OF FERROMAGNETISM IN DIVALENT EUROPIUM SALTS

A. M. de Graaf and R. M. Xavier 1965 9 p refs Submitted for Publication *Its* Notas de Fisica Vol. 11, No. 20

CFSTI: HC $1.00/MF $0.50

The indirect interaction between localized magnetic moments in insulators is shown to account for the occurrence of ferromagnetism in the divalent europium salts EuO, EuS, and EuSe. When the interaction is applied to the magnetic f.c.c. lattice of the divalent europium salts, it is found to favor ferromagnetism. The theory of superexchange in insulators is discussed, and it is suggested that the kinetic exchange can overcome the direct and the indirect interactions. N.E.N.

N66-35192# Royal Military Coll. of Science, Shrivenham (England).

THE GROWTH OF SINGLE CRYSTALS OF NICKEL OXIDE

M. C. Lovell [1963] 32 p refs

(Contract AR(b)IMG/196/01/2) CFSTI: HC $2.00/MF $0.50

Single crystals of nickel oxide have been grown by two methods: (a) a floating zone technique using an arc image furnace as a heat source, and (b) an epitaxial technique in which crystals grow from vapor on to a magnesium oxide substrate. By method (a) crystals about 0.75 cms long and 6 mms in diameter have been grown. These are black in color, due to the presence of excess oxygen, and are rather badly strained. Method (b) produces crystals up to 300 microns thick and 1 cm in diameter which are green in color and nearly stoichiometric. Author

N66-35227*# Illinois Univ., Urbana. Dept. of Physics.

ANNEALING OF FAST NEUTRON DAMAGE IN IMPURITY-CONDUCTING N-TYPE GERMANIUM

E. L. Wolf, W. Dale Compton, and S. W. Depp [1966] 16 p refs

(Grant NsG-228-62)

(NASA-CR-77483) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Thermal annealing of fast neutron induced changes in the electrical properties of highly doped, non-degenerate, n-type germanium was investigated. Samples were irradiated for six hours by a neutron flux of approximately $4\times10^{16}/cm^2$. They were then annealed at 10°C intervals from 100° to 380°C, 45 minutes at each temperature. Data are presented in graph form for the resistivity vs 1/T relation, and for the fraction unannealed. The results found are: a lack of major annealing below 300°C of all quantities except the scattering center concentration; the gradual annealing and then distinct anneal stage at 275°C; and the failure of the carrier concentration to anneal completely. Reasons for results different from those obtained by gamma radiation are suggested. It is further suggested that the sharp annealing stage at 310°C is more likely the breakup of some complex of simple defects with the abundant antimony than the breakup of disordered regions. N.E.N.

N66-35238*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.

THE ABSOLUTE QUANTUM EFFICIENCY OF CALCIUM TUNGSTATE WITH LEAD IN THE EXTREME ULTRAVIOLET REGION Scientific Report No. 1, 1 Feb. 1965-30 Jun. 1966

Virendra Nath Saxena [1966] 76 p refs

(Grant NGR-06-003-034)

(NASA-CR-77508) CFSTI: HC $3.00/MF $0.75 CSCL 20L

The application of a method for measuring the absolute quantum efficiency of a luminescent material is discussed. The absolute quantum efficiency of $CaWO_4$ with 0.70% lead by weight was measured at room temperature at five selected

uv wavelengths. A thermopile made of gold and blackened with evaporated colloidal gold, and a specially constructed photomultiplier type photometer were used to measure the intensity of the incident uv radiation and the luminescent radiation coming out from the back of a thin phosphor screen, respectively. The absolute quantum efficiency of the phosphor was found to be of the order of 4.95 at 304 Å, 3.53 at 461 Å, 3.02 at 584 Å, 1.49 at 1048 Å and 1.47 at 1216 Å, i.e., decreasing with increasing wavelengths in the extreme ultraviolet. There was a suggestion of the possibility of the efficiency attaining a constant value for wavelengths greater than 1000 Å. Author

N66-35241*# Naval Ordnance Test Station, China Lake, Calif.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE PHYSICS OF CRYSTALLINE SURFACES Second Quarterly Status Report, 1 May–31 Jul. 1966
E. Bauer [1966] 69 p refs
(NASA Order R-05-030-001)
(NASA-CR-77475) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Continuing researches on crystalline surface physics are reported. Emphasis was placed on a discussion of the relation between structure of epitaxy of f.c.c. metals on alkali halides with different surface conditions in ultrahigh vacuum. Contamination by CO during the scanning interval was considered to cause the lack of reproducibility of measurements of the (00) beam intensity from a tungsten (110) surface made as the angle of incidence was varied. Results of investigations on the relation between structure and electron emission properties of work function reducing layers on tungsten (110) planes indicate a complex dependence of the emission properties on film thickness, deposition or annealing temperature, and annealing time. The importance of relativistic effects in the scattering of slow electrons by atoms is also discussed. N.E.N.

N66-35286# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
THE SUPERCONDUCTING TRANSITION TEMPERATURES OF Nb_6Sn_5 AND $NbSn_2$
J. P. Charlesworth Apr. 1966 9 p refs
(AERE-R-5198) CFSTI: HC $1.00/MF $0.50

Superconducting transitions have been found at 2.07° in Nb_6Sn_5 and 2.68° K in $NbSn_2$. Previously reported values [6] are <0.3° K for Nb_6Sn_5 and 2.6° K for $NbSn_2$. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems

N66-34154# Princeton Univ., N. J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
THE HOMOGENEOUS GAS PHASE KINETICS OF REACTIONS IN THE HYDRAZINE–NITROGEN TETROXIDE PROPELLANT SYSTEM
Robert F. Sawyer 1965 339 p refs *Its* Tech. Rept.-761
(Contract AF 49(638)-1268)
(AFOSR-66-0855; AD-634277) CFSTI: HC $7.00/MF $1.25

A number of different homogeneous gas phase reactions arising from the possible combinations of the fuels: hydrazine, ammonia, hydrogen, and decomposed hydrazine with the oxidizers: nitrogen dioxide, oxygen, nitric oxide, and decomposed nitrogen dioxide were investigated in the same adiabatic flow reactor at temperatures falling between 800°K and 1300° K. Heats of reaction, reaction orders, and reaction rates were determined. From the measured reaction rates, Arrhenius rate constants were calculated and overall activation energies determined. Based on the experimental observations and the work of other investigators on related reactions, reaction mechanisms were postulated. Author (TAB)

N66-34652*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF EXPERIMENTAL AND KINETICALLY LIMITED THEORETICAL PERFORMANCE OF THE HYDROGEN–FLUORINE PROPELLANT SYSTEM
David A. Bittker Washington, NASA, Aug. 1966 19 p refs
(NASA-TN-D-3607) CFSTI: HC $1.00/MF $0.50 CSCL 21I

Theoretical calculations of the performance of a hydrogen–fluorine (H–F) rocket engine were performed, and the results were compared with experimental data for three nozzles, each with an area ratio of 100. The chamber pressure was 60 pounds per square inch absolute, and oxidant–fuel ratios from 7 to 19 were used. A one-dimensional theoretical model, used with an assumed reaction mechanism and rates, gave results in good agreement with experiment for the contoured and 25°-angle conical nozzles. Results for the longer 15°-angle conical nozzle agreed qualitatively but not quantitatively with experiment. The theoretical results agreed with the experimentally observed trend of performance with change in nozzle configuration. Variation of the H+H recombination rate had about the same absolute effect on performance over the entire oxidant–fuel ratio range, whereas variation of the H+F recombination rate had a much larger absolute effect at high oxidant–fuel ratio values than at low values. The assumed rate for the H+F recombination, which gave resonable agreement between theory and experiment, was consistent with the recently published theoretical and experimental rate information on this reaction. Also, the kinetically calculated gas temperature profile through the contoured nozzle was not highly sensitive to increase in the oxidant–fuel ratio. Author

N66-34701*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REVIEW OF SOLID PROPELLANTS FOR SPACE EXPLORATION
Frank J. Hendel 1 Oct. 1965 23 p refs
(Contract NAS7-100)
(NASA-CR-77354; JPL-TM-33-254) CFSTI: HC $1.00/MF $0.50 CSCL 21I

Various families of solid propellants which are or could be used in space vehicles and spacecraft are reviewed. These include polyurethane, polybutadiene–acrylic acid, polybutadiene–acrylic acid–acrylonitrile, carboxyl-terminated polybutadiene, double base, and thermoplastic polymers as fuel and binders of the crystalline oxidizers with or without aluminum or beryllium powder. Future solid propellants will have improved physical properties and specific impulse. Improved specific impulse will result from the use of energetic oxidizers, such as lithium ozonide, energetic fuel-binders such as nitropolymers and acetylenic polymers, and energetic fuel ingredients such as light metal hydrides. An ultra-energetic cryogenic solid propellant could be made by freezing a mixture of liquid oxygen and hydrogen or a light metal hydride. A "cold" solid propellant made from BeH_2 and frozen hydrogen peroxide will have a theoretical vacuum specific impulse of almost 500 sec. Author

N66-34799*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
A STUDY OF PROPELLANT BEHAVIOR AT ZERO GRAVITY Final Report

E. T. Benedikt 15 Apr. 1966 120 p refs
(Contract NAS8-11097)
(NASA-CR-77358; SID-66-286) CFSTI: HC $4.00/MF $1.00 CSCL 20I

Results of an analytical and experimental study of the behavior of liquids under conditions of zero gravity are presented. A general analytical method has been formulated for the prediction of the kinematics of a liquid having a free surface and subjected to the joint action of gravitational, surface, and interfacial tension forces, as well as to the effects of an arbitrary translational motion imparted to the tank. The general formulas were specialized for application to the case of liquid in a cylinder subjected to axial and lateral forced translations. An automatic numerical procedure was developed for the integration of the equations of motion of the liquid. A concurrent experimental program provided data for verification of the analytical method. A comparison of observed and computed results provides satisfactory agreement within the computational accuracy maintained. Problems of heat transfer and boiling are discussed. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-34248# Boeing Co., Wichita, Kans. Airplane Div.
FOREIGN OBJECT INGESTION PREDICTION FOR ENGINE INLETS BY TRAJECTORY ANALYSIS IN A POTENTIAL FLOW FIELD Final Report
Dale W. Brees and William F. Schmidt 29 Dec. 1965 47 p refs
(Contract NOw-65-0273-f)
(D3-6961-2; AD-634387) CFSTI: HC $2.00/MF $0.50

An investigation was made of the application of a water droplet trajectory computer program to the prediction of foreign object ingestion of engine inlets. Variations of particle size, weight and initial conditions on particle trajectories were investigated for a stationary and a moving engine inlet potential flow field. A surface-particle resilience factor used with an added solid particle ricochet routine was also evaluated. The computed results provide an adequate solution for plane flow fields or the vertical centerline plane of an axially symmetric flow field. Author (TAB)

N66-34625# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
SOLID PROPELLANT COMBUSTION INSTABILITY: OSCILLATORY BURNING OF SOLID ROCKET PROPELLANTS Scientific Report, 1 Jun. 1963–30 Sep. 1964
R. H. Woodward Waesche and Martin Summerfield Aug. 1965 310 p refs *Its* Rept.-751
(Grant AF-AFOSR-448-63; ARPA Order 317-62)
(AFOSR-66-0937; AD-634278) CFSTI: HC $7.00/MF $0.50

Contents: The Occurrence of Combustion Instability in Solid Propellant Rocket Motors; The Morphology of Combustion Oscillation; Theories of Elemental Processes in Combustion Instability—A Literature Survey; A Detailed Discussion of Pressure Coupling with the Surface Flame Zone; Experimental Studies on the Nature of the Pressure-Surface Flame Coupling; Consideration of Possible Experiments to Measure Acoustic Admittance; Acoustic Admittance and Entropy Waves; Experimental Results; Damping Mechanism Studies; Conclusions and Future Experiments. Author (TAPI

N66-34885*# California Univ., Berkeley. Space Sciences Lab.
INVESTIGATION OF KILOVOLT ION SPUTTERING Quarterly Progress Report, May–Jul. 1966
Harold P. Smith, Jr., F. C. Hurlbut, T. H. Pigford, and N. Thomas Olson 31 Jul. 1966 22 p refs *Its* Ser. No. 7, Issue 31
(Contract NAS3-5743)
(NASA-CR-54908) CFSTI: HC $1.00/MF $0.50 CSCL 21C

To decrease sputtering or ionic erosion of the accel electrode and focusing structure of the ion rocket engine, the angular distribution of sputtered aluminum was determined by the electron microprobe. It is considered that this technique offers improved resolution over the radioactive tracer technique previously developed for cesium-copper sputtering. Proportional counter technique and operation was improved to facilitate complete separation of the oxygen characteristic X-ray peak from the associated low energy noise. Preliminary data is also presented in which neutron activation analysis after cesium ion bombardment of aluminum was incorporated with the standard anodization-strip technique. It was found that the median range of penetration is less than that encountered at low dose rate. R.Li.

N66-35210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 5-CENTIMETER-DIAMETER ELECTRON-BOMBARDMENT THRUSTOR WITH PERMANENT MAGNETS
Joseph F. Wasserbauer Washington, NASA, Sep. 1966 34 p refs
(NASA-TN-D-3628) CFSTI: HC $2.00/MF $0.50 CSCL 21C

An attempt was made to optimize a permanent magnet thrustor version of an electromagnet ion thrustor suitable for station keeping and attitude control of a synchronous earth satellite. Results from the investigation showed that a permanent magnet version of the electromagnet thrustor gave ion-chamber performance comparable or slightly better than the electromagnet thrustor for all electrical parameters investigated. Comparison of chamber performance over a range of propellant flow rates showed that the best ion-chamber performance for both thrustors was obtained for propellant flow rates from 0.035 to 0.050 equivalent ampere. Comparison of both thrustors on the basis of the power to thrust ratio showed that the permanent magnet thrustor had an improvement in performance of approximately 12 percent over that of the electromagnet thrustor. A power to thrust ratio of 165 watts per millipound was obtained at a thrust of 0.69 millipound and a net accelerating voltage of 3000 volts for the permanent magnet thrustor when the neutralizer and vaporizer power losses were neglected. Reasonable estimates of these losses would increase the power to thrust ratio to only 200 watts per millipound. Author

N66-35306*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE "DELTA P" APPROACH FROM NIKE COMBUSTION INSTABILITY
Abram Hisler 4 Oct. 1965 8 p refs Presented at the 2d ICRPG Combust. Instability Conf., El Segundo, Calif., 1–5 Nov. 1965 Submitted for Publication
(NASA-TM-X-56943) CFSTI: HC $1.00/MF $0.50 CSCL 21H

The applicability of the delta p approach to the study of combusion instability in liquid and solid propellant rocket engines is reported. Using this approach, it is assumed that at sufficiently high pressure drop across the combustion chamber provides the necessary turbulence level to suppress unstable burning by reducing the effect of swirl on nozzle flow, and by reducing the heat flow back toward the burning surface. In view of these findings, experimental objectives in the area of combustion instability are cited. S.C.W.

N66-35325*# National Aeronautics and Space Administration, Washington, D. C.
SECOND 260-INCH SOLID MOTOR SET FOR TEST FIRING
15 Feb. 1966 17 p
(NASA News Release-66-31) Available from the Scientific and Technical Information Division CSCL 21H

This report discusses various aspects of the second 260-inch diameter solid propellant rocket motor prior to its test firing of February 23, 1966. The objectives of the solid motor project are described along with features of the motor, its developmental background, igniter motor, instrumentation, and sequence of firing events. R.N.A.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-34592# Liege Univ. (Belgium). Inst. of Astrophysics.
HYPERFINE STRUCTURE OF MN I LINES IN THE SOLAR SPECTRUM. PHOSPHORUS LINES IN THE SOLAR SPECTRUM
J. W. Swensson 30 Apr. 1966 33 p refs *Its* Tech. Notes Nos. 3 and 4
(Contract AF 61(052)-685)
(AFCRL-66-453; AD-635504) CFSTI: HC $3.00/MF $0.50

On high-resolution photometric tracings of the solar spectrum taken by L. Delbouille and G. Roland certain Mn I lines near λ 8700, belonging to the multiplet y^6p^0—e^6d, have wide, complex profiles that are attributed to hyperfine structure. Structures at λ λ 8741, 8704 and 8701 Å are analysed. The earlier identifications of P I lines by Babcock and Moore are confirmed. An abridged multiplet table giving laboratory and solar data lists 26 lines due to neutral phosphorus, including some blends, in the infrared region of the Fraunhofer spectrum. Eighteen of the P I assignments are new: of these, four are subject to some doubt. Six of the new identifications are based on prediction. Author (TAB)

N66-34728# Brookhaven National Lab., Upton, N. Y. Chemistry Dept.
SOLAR NEUTRINOS
Raymond David, Jr. and Don S. Harmer [1964] 16 p refs Presented at Texas Symp. on Relativistic Astrophys., Austin, Tex.
(Contract AT(30-2)-GEN-16)
(BNL-9043; CONF-641214-2) CFSTI: HC $1.00/MF $0.50

An experiment for observing the solar neutrino radiation, based on the neutrino capture reaction $\nu + {}^{37}Cl \rightarrow {}^{37}Ar + e^-$, is discussed. The expected solar neutrino cross section in ^{37}Cl was calculated. A pilot experiment, to test the method, was performed with 1000 gal (6.1 tons) of perchloroethylene (C_2Cl_4), corresponding to an expected capture rate of 0.05±0.03 per day. The experimental upper limit found on the capture rate is roughly five times as large as the calculated rate. Plans for a large-scale experiment, using 610 tons of perchloroethylene, are discussed, and the general experimental arrangement is described. NSA

N66-34787*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY AND GAMMA-RAY ASTRONOMY
A. G. W. Cameron *In* NASA, Washington Significant Achievements in Space Astronomy 1958–1964 1966 p 13–26 (See N66-34786 20-30) CFSTI: HC $0.45/MF $0.75

Sources for X-rays and high-energy gamma rays are discussed in terms of implications to space astronomy. Possible source mechanisms for X-rays mentioned are: (1) Bremsstrahlung from hot plasma, (2) inverse Compton effect whereby energetic electrons scatter starlight photons, (3) synchrotron radiation produced by energetic electrons spiraling in a magnetic field, and (4) thermal emission of a Planck spectrum from the surface of a hot compact neutron star. It is pointed out that these mechanisms make different predictions of spectral shape, angular width, and possible polarization characteristics of X-ray sources; and that more refined experiments than can presently be performed are necessary to determine which, if any, of these mechanisms provides the source. It is concluded that intergalactic space is not filled with a very hot plasma. It is noted that high-energy gamma rays may be produced by the decay of neutral pions from cosmic ray collisions with interstellar material; and that the galaxy contains very little antimatter, which rules out certain types of matter creation in a steady-state universe. M.W.R.

N66-34924# Martin Co., Baltimore, Md. RIAS Div.
THE STUDY AND INVESTIGATION OF NEUTRONS PRESENT ABOVE THE ATMOSPHERE IN NEAR-EARTH SPACE Final Report, 1 Jun. 1963–31 Jan. 1966
Joseph P. Martin and James B. Mead Mar. 1966 77 p refs
(Contract AF 19(628)-3253)
(AFCRL-66-206; AD-635525) CFSTI: HC $4.00/MF $0.75

The density of neutrons above the atmosphere was measured by a pair of BF3 proportional counter systems aboard a polar orbiting satellite. The shape of the latitude variation of the measured density (10:1 between poles and equator) was consistent with theoretical predictions, but the measured absolute values were about three times higher. Since neutrons in the vicinity of earth are produced by cosmic ray interactions, instrumentation was developed to measure the poorly known heavy element component of the cosmic radiation. A large area scintillator–Cerenkov telescope with a geometric factor of 176 sq cm stearadian was developed in prototype for measurements from high altitude balloons. The principal difficulty in developing a telescope with large aperture (necessary for good counting statistics) is maintaining good pulse height resolution. This was solved for the Cerenkov detector with a technique of optical trimming of the photomultiplier cathodes. A number of detection schemes for high energy neutrons were investigated including a proton recoil detector, a C12-3 alpha detector, and bismuth fission detectors. The conclusion of this study is that a compact multiplate fission ionization chamber would be more practical than a bismuth loaded liquid scintillator. TAB

N66-34891*# IIT Research Inst., Chicago, Ill.
OPTICAL DETERMINATION OF TEMPERATURE VARIATIONS THROUGHOUT THE SOLAR CORONA DURING THE ECLIPSE OF MAY 30, 1965 Final Report, 1 Feb.–31 Jul. 1965
Gordon Henderson 23 Aug. 1965 11 p
(Contract NASr-65-(12))
(NASA-CR-64824; IITRI-A6122) CFSTI: HC $1.00/MF $0.50 CSCL 03B

This report describes the unloading operations, setting up of camp and equipment, and the equipment checkout tests in a project to optically determine temperature variations throughout the solar corona during the eclipse of May 30, 1965. The checkout of the interferometer performance is outlined. Weather conditions on the morning of the eclipse are briefly described along with the measurements which were made at 80 different points around the sun. A preliminary review of the results showed that on about 20 scans, involving a dozen different viewing regions, a distinct feature appeared near λ8303 Å. The wavelength calibration is unambiguous

since the absorption line used for calibrations had a wavelength of 5302.3 Å, while the undisplaced Fe XIV emission line was at 5302.86 Å. Hence, the calibration line and the emission line were each transmitted through the interferometer in the same order of interference. Examples of the emission features are shown. The equipment behaved well and if the analysis shows that the emission was observed in spite of the cloudy conditions, this would present a strong case for further development of the photoelectric recording Fabray–Perot interferometer for coronal emission line observations. R.N.A.

N66-35063# RAND Corp., Santa Monica, Calif.
ELECTRON IONIZATION AND LOSS PROCESSES AND RATES
C. M. Crain Jun. 1966 51 p refs Presented at the Conf. on Ground-Based Radio-Wave Propagation Studies of the Lower Ionosphere, Ottawa, 11–15 Apr. 1966
(P-3389; AD-635039) CFSTI: HC $2.00/MF $0.50

Cosmic rays and nuclear explosion fission products factors which relate to the ionization state in the region below roughly 100 km are summarized. TAB

N66-35131# Max-Planck-Institut für Aeronomie, Lindau uber Northeim (West Germany).
THE ANISOTROPY OF COSMIC RAYS [DIE ANISOTROPIEN DER KOSMISCHEN STRAHLUNG]
Erhard Kirsch Berlin, Springer–Verlag, 1964 78 p refs In GERMAN *Its* Mitt. No. 16
CFSTI: HC $3.00/MF $0.75

Cosmic radiation data from IGY stations together with local German observations were evaluated for their time and location dependent nucleon particle anisotropy. Harmonic as well as graphic analyses of periodic fluctuations established a correlation between the Earth's magnetic field strength and detector registration values. The betatron effect and shifting of plasma clouds seem to be responsible for the observed quasi-periodic fluctuations. Transl. by G.G.

N66-35311*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
RADIO CERENKOV RADIATION FROM A PRIMARY COSMIC RAY
I. Lerche Oct. 1965 22 p refs Submitted for Publication (Grant NsG-96-60)
(NASA-CR-68058; EFINS-65-94) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The radiation field of a primary cosmic ray moving in straight line motion in the Earth's atmosphere is discussed. The particle is taken to have a velocity in excess of the velocity of light in the medium, and also to have a Lamor radius greater than a scale height of the atmosphere. It is shown that the polarization of the electric vector is nearly radial in the plane perpendicular to the track of the cosmic ray. It is also shown that the radiation is detectable at centimeter wavelengths provided a radio telescope of size in excess of about 80 meters is used, that the integration time of the receiver is about 20 microseconds and that the noise temperature is less than about 20°K. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-34195# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 4, PART 2
1965 57 p refs
(Contract AF 19(628)-4332)
(AD-634501) CFSTI: HC $3.00/MF $0.75

CONTENTS:

1. THE REDUCTION OF MEASURES FOR POSITION ON A SINGLE LUNAR PHOTOGRAPH D. W. G. Arthur 4 p refs (See N66-34196 20-30)

2. SELENODETIC MEASURES ON YERKES LUNAR PHOTOGRAPH NO. 1170 D. W. G. Arthur 44 p refs (See N66-34197 20-30)

3. THE COMPUTATION OF SELENODETIC COORDINATES USING THE LIBRATIONS D. W. G. Arthur 8 p refs (See N66-34198 20-30)

N66-34196# Arizona Univ., Tucson.
THE REDUCTION OF MEASURES FOR POSITION ON A SINGLE LUNAR PHOTOGRAPH
D. W. G. Arthur *In its* Commun. of the Lunar and Planetary Lab., Vol. 4, Pt. 2 1965 4 p refs *Its* Commun. No. 60 (See N66-34195 20-30) CFSTI: HC $3.00/MF $0.75

This paper details the computational methods used to convert raw measures on lunar photographs into rectangular coordinates that are free of refraction. Author

N66-34197# Arizona Univ., Tucson.
SELENODETIC MEASURES ON YERKES LUNAR PHOTOGRAPH NO. 1170
D. W. G. Arthur *In its* Commun. of the Lunar and Planetary Lab., Vol. 4, Pt. 2 1965 4 p refs *Its* Commun. No. 61 (See N66-34195 20-30) CFSTI: HC $3.00/MF $0.75

Details are given of 1538 coordinate measurements on Yerkes lunar photograph No. 1170. The catalog lists the refraction-free photographic coordinates of 1099 points on the disk. The selenographic coordinates of the projections of these on the spherical lunar datum are also listed. The limb of this photograph is represented by the refraction-free rectangular and polar coordinates of 439 points on the profile. Author

N66-34198# Arizona Univ., Tucson.
THE COMPUTATION OF SELENODETIC COORDINATES USING THE LIBRATIONS
D. W. G. Arthur *In its* Commun. of the Lunar and Planetary Lab., Vol. 4, Pt. 2, 1965 8 p refs *Its* Commun. No. 62 (See N66-34195 20-30) CFSTI: HC $3.00/MF $0.75

Details are given of the method for combining measures on different lunar photographs, using the librations, to compute selenodetic coordinates. Published methods are critically examined, and the correct treatment of pseudo-observation is outlined. A first-order treatment of the error theory for a selenodetic positions is derived from the method of combining plates. Author

N66-34269# Mitre Corp., Bedford, Mass.
HIGH-ALTITUDE REENTRY DRAG EFFECTS
Stanley Sharenson Bedford, Mass., AFSC, Electron. Systems Div., Jun. 1966 20 p ref
(Contract AF 19(628)-5165; ARPA Order 596; Proj. Defender) (MTR-160; ESD-TR-66-95; AD-634390) CFSTI: HC $1.00/MF $0.50

The effect of atmospheric drag on the trajectory of a reentry body is considered. The analysis is valid in the high altitude regime. Results are presented as the differential displacement and velocity from the vacuum trajectory for various values of ballistic coefficient. Author (TAB)

N66-34284# Library of Congress, Washington, D. C. Aerospace Technology Div.
SOVIET LONG-RANGE SPACE-EXPLORATION PROGRAM Surveys of Communist World Scientific and Technical Literature
Vladimir E. Mutschall 16 Feb. 1966 36 p refs Analytical Surv.
(ATD-66-18; AD-633962) CFSTI: HC $2.00/MF $0.50

This analytical survey is based on Soviet open sources published 1956–1965. It is one of a series of reports dealing with the soviet long-range space-exploration program and is concerned, in particular, with lunar surface research. Information not directly related to this subject has been included because of its broad implications for study in this field. This report may prove useful to lunar mission planners, both those concerned with the purely scientific aspects of the moon's surface and immediate subsurface and those involved in the development of lunar exploration vehicles and in the establishment of permanent lunar bases. Information is divided as follows: photometric observations; spectral observations; measurement of lunar temperatures; the meteor slag theory; interpretation of lunar craters; lunar-seismicity; radio echo studies; lunar atmosphere. The main purpose of this report is to present an up-to-date summary of the current state of soviet knowledge concerning the surface of the moon. The question of lunar topography is of obvious importance to the landing of instrument packages and manned vehicles on the moon. Every major aspect of the current lunar research program has been considered and all pertinent evidence available from Soviet. TAB

N66-34296# Liege Univ. (Belgium). Dept. of Astrophysics.
RESEARCH ON RELATIONS BETWEEN COMETARY, SOLAR AND UPPER ATMOSPHERIC PROCESSES Annual Summary Report No. 4, 1 Apr. 1965–31 Mar. 1966
Pol Swings 25 Apr. 1966 34 p
(Contract AF 61(052)-587)
(AFCRL-66-433; AD-634918) CFSTI: HC $2.00/MF $0.50

Laboratory work has been carried on: the time resolution of spectra; the spectra of several molecules of astronomical interest; various instruments; the study of photomultipliers. The physical mechanisms in comets have been further discussed. Other programs of cometary and solar investigations have been started. Investigations related to space experiments are mainly concerned with the far ultraviolet spectra stars, comets and aurorae, and with artificial comets. Author (TAB)

N66-34327*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
INTERACTION OF METEOROIDS WITH THE ATMOSPHERE. I: STONY MICROMETEORITES
Ernst J. Oepik and Ellen G. Stolarik Jun. 1966 44 p refs *Its* Tech. Rept.-577
(Grant NsG-58-60)
(NASA-CR-77300) CFSTI: HC $2.00/MF $0.50 CSCL 03B

The process of energy dissipation through radiation and evaporation, deceleration by drag, and ablation through evaporation of spherical stony micrometeorites has been studied numerically. Interpolation procedures are developed, yielding survival radii and maximum temperatures for entry velocities ranging from 7.6 to 46 km/sec, and for initial radii less than 0.07 cm. The radii are tabulated for vertical incidence; for oblique incidence, they must be multiplied by the secant of the angle of incidence. The lower limit of initial radii of interplanetary particles which can be expected to enter the terrestrial atmosphere is about 2×10^{-5} cm, as conditioned by solar radiation pressure. Micrometeorites of lunar orgin can be very much smaller, down to near-molecular dimensions as conditioned by the luminosity-to-mass ratio of the earth, 1650 times smaller than the solar value. Micrometeorites of 0.4–2 micron radius can escape excessive heating during atmospheric entry at oblique incidence ($z = 75°$ to near grazing) and could act as carriers of living germs from other planets. Author

N66-34352# Army Dept., Washington, D. C. Office of the Chief of Engineers.
LUNAR DEVELOPMENTAL HISTORY AND ITS ENGINEERING IMPLICATIONS Final Report, Jun. 1964–Jul. 1965
Bruce M. Hall Jun. 1966 44 p refs
(TN-66-201; AD-633784) CFSTI: HC $2.00/MF $0.50

Observed data and current theories were studied to explain the selonologic character and engineering properties of the lunar surface. Formation of the moon by accretion of cold particles, followed by internal heating, complete melting, magmatic differentiation and planetary cooling and degassing is postulated. Principal lunar surface features resulted from infall of space debris, magma flows, crustal deformation and surface erosion by sputtering, meteoroid impact and ejecta from primary impacts. Evidence is presented to support the hypothesis. engineering properties of the lunar surface are postulated for an average marial topographic province. The lunar surface is composed principally of granular material varying as to granular gradation. Soil bearing strength, compaction, adhesion, excavation procedures, trafficability, dust propogation and surface temperatures are considered. Similar engineering data for the highlands may not be induced at this time because of their more heterogeneous character. Author (TAB)

N66-34528# Boeing Scientific Research Labs., Seattle. Geo-Astrophysics Lab.
ON THE NONUNIFORM COOLING BEHAVIOR OF THE ECLIPSED MOON
D. F. Winter May 1966 10 p refs
(DI-82-0531; AD-634303) CFSTI: HC $1.00/MF $0.50

Anomalous cooling of certain regions of the moon during an eclipse may be attributable to preferential surface roughness on a centimeter scale. Several arguments are presented in support of this hypothesis and a quantitative illustration is displayed. Implications with regard to lunar crater evolution are discussed briefly. Author (TAB)

N66-34553# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE EVOLUTION OF ORBITS OF ARTIFICIAL EARTH SATELLITES IN CONNECTION WITH SOLAR ACTIVITY
N. P. Slovokhotova *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 33–44 ref (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

Discussed is the dependence of satellite orbit evolution (and upper atmosphere density) and solar activity. The data are based on optical observation of four satellites and were obtained from published U.S. and Soviet sources. Considered were: (1) change of nodal period; (2) height of perigee above terrestrial ellipsoid; and (3) angular geocentric distance between perigee and sun. Height and diurnal effect were eliminated from the consideration of deceleration. The results are presented in form of graphs plotted for every satellite and are followed by a discussion and evaluation. No clear evidence of a connection between deceleration of satellites and solar activity was established, but such a connection is still thought to exist. K.W.

N66-34554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRELIMINARY AVERAGE ORBITAL ELEMENTS OF THE CABIN OF THE FIRST SOVIET SPACE SHIP (1960 E_3 FOR OCTOBER–DECEMBER 1962
G. A. Chebotarev and Ye. N. Makarova *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 45–47 (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

Equatorial elements and secular perturbations for the Soviet Epsilon$_3$ satellite for October–December 1962 are presented in tabulated form. The elements were obtained through approximate visual observations. Calculations were carried out on a high speed BESM-2 machine. K.W.

N66-34555# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRELIMINARY ORBITAL ELEMENTS OF SOVIET ARTIFICIAL EARTH SATELLITE COSMOS 8 (1962 α XI$_1$) AND ITS ROCKET-CARRIER (1962 α XI$_2$)

G. A. Chebotarev and Ye. N. Makarova *In its* Bull. of Sta. of Opt. Observation of Artificial Earth Satellites 13 Jan. 1966 p 48–50 (See N66-34546 20-07) CFSTI: HC $3.00/MF $0.75

Equatorial elements and secular perturbations for the Soviet Cosmos 8 satellite and its carrier rocket for September–December 1962 are presented in tabulated form. The elements were obtained through approximate visual observations. Calculations were carried out on a high speed BESM-2 machine. Data obtained for the satellite and its carrier rocket in England are included for comparison. K.W.

N66-34567# Library of Congress, Washington, D. C. Aerospace Technology Div.

OPTIMIZATION OF THE TRAJECTORY OF MULTISTAGE FLIGHT VEHICLES

Leonas Kacinskas *In its* Foreign Sci. Bull., Vol. 2, No. 8 Aug. 1966 p 1–3 ref (See N66-34566 20-34)

The optimal flight of a multistage flight vehicle is analyzed in the case when the curvature of the earth and its rotation are taken into account and the constraints imposed on the control function are of the inequality type. Necessary and sufficient conditions under which the determined trajectory minimizes the performance functional are investigated. Author

N66-34635*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A STUDY OF FLARE STARS

Leonard H. Solomon 12 May 1966 50 p refs *Its* Spec. Rept.-210
(Grant NsG-87-60)
(NASA-CR-77289) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Information is provided on the history of flare star observations and correlated with the present research. General considerations and observing procedures are reviewed and reduction methods for photographic observations are discussed. Tables which summarize the observations made during this program are provided and a general discussion of these observations emphasizes the following points: (1) The stellar flare phenomena observed is nonthermal. (2) Most of the events observed are somewhat analogous to solar noise storms. (3) The rate at which energy must be produced by a flare mechanism is at least a large fraction of the stellar energy production rate. H.S.W.

N66-34678*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.

INVESTIGATION OF SPUTTERING EFFECTS ON THE MOON'S SURFACE Eleventh Quarterly Status Report, 25 Oct. 1965–24 Jan. 1966

G. K. Wehner, D. L. Rosenberg, and C. E. Ken Knight 8 Mar. 1966 92 p refs *Its* Rept.-2947
(Contract NASw-751)
(NASA-CR-77183) CFSTI: HC $3.00/MF $0.75 CSCL 03B

Studies of the Luna 9 photographs imply that the lunar surface is probably cohesive. Using recently published photoelectric data, analysis has been made of the shape of the photometric function of the lunar surface. This analysis indicates the presence of an underdense surface of very small opaque particles. Reconciliation of these indicated properties could be obtained by sintering and cold-welding of the surface material. The effect of surface roughness on the net ion sputtering rate has been restudied. The decrease in rate with increase in roughness is greater than previously measured. The high sputtering yields of solid graphite when bombarded by hydrogen ions indicate reactive or chemical sputtering is the dominant erosional process and it is unlikely that free carbon will be found on the solar-wind exposed lunar surface. Author

N66-34697*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N. Y.

RESEARCH ON CELESTIAL MECHANICS AND OPTIMIZATION: SECOND-ORDER SOLUTION OF THE POLAR OBLATENESS PROBLEM Final Report

John J. Morrison 30 Jun. 1966 51 p refs
(Contract NAS8-20130)
(NASA-CR-77352; FHR-2712-6) CFSTI: HC $3.00/MF $0.50 CSCL 03C

The methods of variation of parameters and averaging are used to obtain a second-order solution for the motion of a satellite about an oblate earth, including the second, third, and fourth zonal harmonics. The parameters used include: two orthogonal unit vectors in the plane of the motion, (one being in the direction of the initial-position vector), and two quantities which are products of the eccentricity and the sine and cosine of the angle from the initial-position vector to the perigee vector, the magnitude of the angular momentum vector, and the epoch. The solution is well behaved for negative energy, (eccentricity less than one), and all inclinations with second-order secular terms occurring for certain inclinations. The second-order, short-period terms are not calculated. Author

N66-34698*# Maryland Univ., College Park.

INTERACTION OF METEORIC BODIES WITH THE TERRESTRIAL ATMOSPHERE

E. J. Opik 27 Jun. 1966 21 p refs
(Grant NsG-58)
(NASA-CR-77357) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Meteorite phenomenology is reviewed. The changes in velocity due to the atmosphere and gravitational field are discussed. The interaction at entry, the air cap, and interaction parameters are described. Details are presented on micrometeorites, visual meteors, and compact meteorites. N.E.N.

N66-34700*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A DIGITALIZED SOLAR ULTRAVIOLET SPECTRUM

R. T. Brinkmann, A. E. S. Green (Florida Univ.), and C. A. Barth 15 Aug. 1966 86 p refs
(Contract NAS7-100)
(NASA-CR-77355; JPL-TR-32-951) CFSTI: HC $3.00/MF $0.75 CSCL 03A

The solar ultraviolet spectrum obtained in rocket experiments is presented in a digitalized form for use in the analysis of upper atmosphere experiments. The data cover the spectral regions between 2990 and 1760 Å and between 1550 and 880 Å. The procedure is described for converting the graphical data into digital form. Above 2085 Å, readings are given every 0.1 Å; below this wavelength, readings are given every 0.2 Å. Both high-resolution and calculated low-resolution spectra are presented. Author

N66-34786*# National Aeronautics and Space Administration, Washington, D. C.
SIGNIFICANT ACHIEVEMENTS IN SPACE ASTRONOMY 1958–1964
1966 71 p refs
(NASA-SP-91) CFSTI: HC $0.45/MF $0.75 CSCL 03A

CONTENTS:

1. X-RAY AND GAMMA-RAY ASTRONOMY A. G. W. Cameron (NASA. Goddard Space Flight Center) p 13–25 (See N66-34787 20-29)

2. ULTRAVIOLET AND INFRARED ASTRONOMY N. G. Roman and J. K. Gleim p 29–45 (See N66-34788 20-30)

3. LOW-FREQUENCY RADIO ASTRONOMY F. T. Haddock (Mich. Univ.) p 49–63 (See N66-34789 20-30)

N66-34788*# National Aeronautics and Space Administration, Washington, D. C.
ULTRAVIOLET AND INFRARED ASTRONOMY
N. G. Roman and J. K. Gleim *In its* Significant Achievements in Space Astronomy 1958–1964 1966 p 29–45 (See N66-34786 20-30) CFSTI: HC $0.45/MF $0.75

Ultraviolet nebulosities, stellar photometry, spectrophotometry, ultraviolet deficiency, and interstellar extinction in the ultraviolet are discussed in relation to developments in ultraviolet astronomy; and a general review is presented of findings in the infrared spectrum by balloons and satellites. It is noted that rocket techniques have been developed for mapping the sky in the ultraviolet; and that pointing control has replaced spinning rockets and earlier methods which employed mechanical collimators. Infrared astronomy with the balloon-borne telescopes Stratoscope I and II are discussed. M.W.R.

N66-34789*# Michigan Univ., Ann Arbor. Radio Astronomy Observatory.
LOW-FREQUENCY RADIO ASTRONOMY
F. T. Haddock *In* NASA. Washington Significant Achievements in Space Astronomy 1958–1964 1966 p 49–63 (See N66-34786 20-30) CFSTI: HC $0.45/MF $0.75

Rockets and satellites have been used primarily for low frequency radio observations to study the cosmic background noise below 10 Mc/sec which do not usually reach surface-bound radio telescopes. Appearance of the radio sky at low and high frequencies is outlined, and restrictions on space radio observations are noted. A review is presented of Canadian, British, and United States researches dealing with low frequency measurements from space; and mention is made of proposed experiments with the Radio Astronomy Explorer satellite which is specifically designed for medium and low resolution measurements of the cosmic background and for observations of low frequency radio bursts from the Sun and planets. M.W.R.

N66-34863*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TOS MISSION OPERATIONS PLAN FOR WTR LAUNCHES
Aug. 1966 89 p
(NASA-TM-X-55554; X-480-66-387) CFSTI: HC $3.00/MF $0.75 CSCL 22B

The NASA–ESSA (Environmental Science Services Administration) joint effort on the Tiros meteorological satellite is reported; the mission operations plan defines NASA's responsibilities, and the necessary interfaces with ESSA. Background data are given for two operational spacecraft, (used for obtaining meteorological data from the entire globe on a daily basis), in circular 750-nm sun-synchronous, near polar orbits. Data sheets show spacecraft characteristics, camera resolution and coverage, video data, and other spacecraft subsystem characteristics. The Goddard Space Flight Center responsibilities and operations cover: launch, mission control, tracking, and telemetry. Field operations are listed for the Tiros launch at the Western Test Range, conducted by elements of Unmanned Launch Operations, Kennedy Space Center, the Tiros Operational System project, Goddard Space Tracking and Data Acquisition Network, the Command and Data Axquisition stations, and the ground communications net. The National Environmental Satellite Center operations, and data processing and analysis responsibilities are also defined. R.Ll.

N66-34876# RAND Corp., Santa Monica, Calif.
REDUCTION OF THE EQUATIONS OF RADIATIVE TRANSFER FOR A PLANE-PARALLEL, PLANETARY ATMOSPHERE. PART I
Zdenek Sekera Jun. 1966 84 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4951-PR, Pt. I; AD-635284)

A discussion is presented of the reduction of the equations of radiative transfer when the phase matrix is separable. A separable matrix is one that can be expressed as the product of two matrices, one whose elements depend on the directional parameters of the incident beam alone, and the other whose elements depend on the directional parameters of the scattered beam alone. When the phase matrix can be developed as a harmonic series in the azimuth difference between the vertical planes containing the scattered and incident beams and each term of this series is separable. The radiative transfer equations have series solutions with each term in these series being given by a product of three matrices; one of these is azimuth-independent; the other two, which post- and pre-multiply this matrix, are the same matrices whose product forms the corresponding term in the phase matrix. Author (TAB)

N66-34928*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS OF THE TWENTY-FOURTH SEMINAR ON SPACE FLIGHT AND GUIDANCE THEORY Progress Report No. 8, 1 Apr.–31 Dec. 1965
23 Jun. 1966 146 p refs Seminar held 16–17 Feb. 1966 Sponsored by Aero-Astrodynamics Lab.
(NASA-TM-X-53478) CFSTI: HC $3.00/MF $1.00 CSCL 22C

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1. FINITE TIME STABILITY OF PERIODIC SOLUTIONS OF HAMILTONIAN SYSTEMS I. S. Bernstein (Gen. Precision, Inc.) p 7–23 refs (See N66-34927 20-19)

2. DISCONTINUOUS VECTOR FIELDS AND FEEDBACK CONTROL H. Hermes (Brown Univ.) p 25–41 refs (See N66-34928 20-10)

3. ESTIMATION OF THE DOMAIN OF ATTRACTION G. R. Geiss (Grumman Aircraft Eng. Corp.) p 43–75 refs (See N66-34929 20-10)

4. A TRANSFORMATION TECHNIQUE TO OBTAIN CONTROL ANGLE SOLUTIONS IN CALCULUS OF VARIATIONS OPTIMIZATION PROBLEMS R. W. Hunt (Southern Ill. Univ.) p 77–90 refs (See N66-34930 20-30)

5. STABILITY CRITERIA FOR n-th ORDER, HOMOGENEOUS LINEAR DIFFERENTIAL EQUATIONS E. F. Infante (Brown Univ.) p 91–110 refs (See N66-34931 20-19)

6. AN INVARIANCE PRINCIPLE IN THE THEORY OF STABILITY J. P. La Salle (Brown Univ.) p 111–129 refs (See N66-34932 20-19)

7. ANALYTICAL SOLUTION OF EULER-LAGRANGE EQUATIONS FOR OPTIMUM COAST TRAJECTORIES C. H. Ng and P. J. Palmadesso (Boeing Co.) p 131–140 refs (See N66-34933 20-30)

N66-34930*# Southern Illinois Univ., Carbondale.
A TRANSFORMATION TECHNIQUE TO OBTAIN CONTROL ANGLE SOLUTIONS IN CALCULUS OF VARIATIONS OPTIMIZATION PROBLEMS
Robert W. Hunt *In* NASA. Marshall Space Flight Center Proc. of the 24th Seminar on Space Flight and Guidance Theory 23 Jun. 1966 p 77–90 refs (See N66-34926 20-30) CFSTI: HC $3.00/MF $1.00

A technique is described for the tranformation of state variables and their corresponding Lagrange multipliers from one coordinate system to another, and application is made to a specific problem involving three-dimensional trajectory optimization in plumbline coordinate and spherical coordinate systems. The equations of motion which simulate vehicle flight through a vacuum for a non-rotating spherical reference body are considered; and thrust and weight flow are assumed constant, with thrust and gravity the only two forces acting on the body. Classical variational calculus techniques are used in the solution, and the transformation of Lagrange multipliers from one coordinate system to another is shown, along with the accompanying transformation of Euler equations. Such a transformation can obtain control angle expressions in terms of Lagrange multipliers in a coordinate system for which such expressions cannot be obtained in a direct fashion. Simplicity in using the transformation technique is cited as another advantage. M.W.R.

N66-34933*# Boeing Co., Huntsville, Ala. Flight Mechanics and Guidance Research Group.
ANALYTICAL SOLUTION OF EULER–LAGRANGE EQUATIONS FOR OPTIMUM COAST TRAJECTORIES
Chiu H. Ng and Peter J. Palmadesso *In* NASA. Marshall Space Flight Center Proc. of the 24th Seminar on Space Flight and Guidance Theory 23 Jun. 1966 p 131–140 refs (See N66-34926 20-30) CFSTI: HC $3.00/MF $1.00
(Contract NAS8-11244)

An analytical solution of the Euler–Lagrange equations for the Lagrange multipliers for optimum coast trajectories (minimum fuel consumption) is obtained. Previous solutions have a singularity at zero eccentricity. The present solution does not have this singularity, but there is a numerical difficulty due to a removable singularity at unit eccentricity. An approximate solution, accurate near unit eccentricity, is given. This solution reduces to the exact parabolic solution for unit ec- Author

N66-34954# Texas Univ., Austin. Dept. of Astronomy.
RADIAL VELOCITIES OF EXTENDED SOURCES BY A SLITLESS SCANNING TECHNIQUE
G. de Vaucouleurs Jul. 1966 23 p ref
(TR-3; AD-634990) CFSTI: HC $1.00/MF $0.50

Description and tests of a double-beam pulse conting spectrophotometer using a tunable interference filter to measure radial velocities of extended astronomical sources, preliminary report of observations of stars, globular clusters, planetary nebulae and galaxies made in March and May 1966 with the 36-inch reflector of McDonald Observatory. Author (TAB)

N66-34992*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
THE TIME-HISTORY OF A SATELLITE AROUND AN OBLATE PLANET
M. C. Eckstein, Y. Y. Shi, and J. Kevorkian Feb. 1965 39 p refs
(Contract NASw-901)
(NASA-CR-67882; Douglas Paper-3529) CFSTI: HC $2.00/MF $0.50 CSCL 22A

In the previous work on the motion of a close satellite around an oblate planet, the orbital elements and perturbations have been described as functions of the central angle between the instantaneous node and the satellite. A complete theory, however, requires the elements and perturbations as functions of the time. Therefore the relationship between time and the central angle between node and satellite is presented here. Although the problem is mathematically nothing but a quadrature, it is practically quite complicated because the evaluation of the occurring integral requires some rather lengthy algebraic manipulations. Part of the calculations are avoided by using a new technique to numerically evaluate certain coefficients that depend only on the initial conditions. Furthermore, the energy integral is used to evaluate certain terms that otherwise would require consideration of higher order terms in the differential equations. Author

N66-35015*# Arizona State Univ., Tempe College of Engineering Sciences.
ATTITUDE STABILITY OF A SPINNING PASSIVE SATELLITE IN A CIRCULAR ORBIT Semiannual Technical Progress Report, Dec. 1, 1965–May 31, 1966
Leonard Meirovitch 31 May 1966 37 p refs
(Grant NGR-03-001-014)
(NASA-CR-77400) CFSTI: HC $2.00/MF $0.50 CSCL 22A

This report concentrates on the problem of nonautonomous systems and in particular on the case in which the coefficients are periodic. These problems have been treated by Floquet's theory, but this is somewhat unsatisfactory since stability can be checked only for given sets of parameters. The approach adopted here can be regarded as consisting of three complementing aspects: a Liapunov-type analysis, and infinite determinant approach and an asymptotic expansion approach. The first is expected to yield the location of the instability regions whereas the latter two should furnish the width of these regions as a function of a small parameter ϵ. The parameter ϵ is related to the difference in the moments of inertia of a spinning satellite about transverse axes and in many practical satellites this difference is made small to minimize periodic torques resulting from gravitational forces. For the Liapunov-type analysis a new theorem has been proposed. The infinite determinant approach as well as the asymptotic expansion approach are believed to be used for the first time for the treatment of problems involving gyroscopic terms. Author

N66-35017*# National Aeronautics and Space Administration, Washington, D. C.
NASA CONFERENCE ON CELESTIAL MECHANICS
Joseph W. Siry et al [1963] 26 p Proc. of conf. held at the Naval Obs., 10–11 Jan. 1963
(NASA-TM-X-57856) CFSTI: HC $2.00/MF $0.50 CSCL 03C

Abstracts are given of the topics discussed at the NASA conference on celestial mechanics, and the discussions concerning these topics are included. The subjects covered include space needs and techniques, geodetic and selenodetic problems, astronomical and computational problems, mathematical problems and periodic orbits, and relativity and gravitation. L.E.W.

N66-35136# Stockholm Observatory (Sweden).
DWINGELOO ATLAS OF 21-CM PROFILES, PART III, WITH A REPRESENTATION IN GAUSSIAN COMPONENTS
Per Olof Lindblad Jul. 1966 41 p refs Bull. of the Astron. Inst. of the Netherlands, Vol. 1, No. 4
CFSTI: HC $2.00/MF $0.50

An atlas of 245 profiles of the 21-cm line around the direction of the galactic anti-centre is presented. The main part of this material together with 130 additional profiles in the same region are represented in the form of Gaussian parameters. They are the result of a Gaussian analysis performed on the corresponding profiles of optical depths. Author

N66-35159# Lockheed Missiles and Space Co., Sunnyvale, Calif.

CONTROL OF THE RELATIVE MOTION BETWEEN SATELLITES IN NEIGHBORING ELLIPTIC ORBITS

William Richard Davis May 1966 185 p refs

(LMSC-6-76-66-12) CSCL 22A

The relative motion between satellites in neighboring orbits is of interest in rendezvous, station keeping, and dispersion (including orbit prediction) missions. This dissertation emphasizes the drag make-up satellite in which satellite air drag is compensated for by continuously thrusting an outer satellite so that it never touches an inner proof mass. The specific problems treated include the nature of the relative motion, the control of relative translative motion for an arbitrarily tumbling outer vehicle and also for a completely attitude-controlled outer vehicle, and the problem of minimizing limit cycle fuel consumption in the presence of noise in the relative position sensor. R.N.A.

N66-35181*# Auburn Research Foundation, Inc., Ala.

APPLICATION OF THE METHODS OF CELESTIAL MECHANICS TO THE RIGID BODY PROBLEM Final Report, 1 Jul. 1965–1 Jun. 1966

Philip M. Fitzpatrick and Jack W. Crenshaw 1 Jun. 1966 37 p

(Contract NAS8-20175)

(NASA-CR-77498) CFSTI: HC $2.00/MF $0.50 CSCL 03C

This report contains the results of a preliminary study aimed at the application of the perturbation methods of celestial mechanics to the rigid body problem, with particular emphasis on the problem of the motion of an artificial earth satellite about its center of mass. Detailed considerations of various representations of the equations of motion and their solution, necessary to a complete understanding of the problem, are given. The pertinent coordinate transformations are described. The method of Hamilton–Jacobi is used to obtain the perturbed equations of motion for a uniaxial body, and groundwork is laid toward the development of a complete first-order theory for the case of gravity-gradient perturbations for such a body. Preliminary results are given for a simplified study of the effects of damping, and a computer integration routine developed for this work is described. Author

N66-35220*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE CLASSICAL "SPHERE-OF-INFLUENCE"

Roger R. Burrows 29 Jun. 1966 36 p refs

(NASA-TM-X-53485) CFSTI: HC $2.00/MF $0.50 CSCL 03C

The classical definition of the "sphere-of-influence" is given and the equation implicitly defining its radius is derived. This equation was solved using a little known iteration technique attributed to Wegstein. Two analytic approximations are derived and the Fourier coefficients through 12th order for the exact result are displayed for the moon and each planet in the solar system. Several "spheres" about the moon computed according to these results are displayed graphically for the earth-moon system. Author

N66-35234*# Aeronutronic, Newport Beach, Calif.

ANALYSIS OF PERTURBATION SOLUTIONS OF VARIED THRUST TRAJECTORIES Final Report

Richard R. Auelmann and Phillip T. Lane 27 Jun. 1966 85 p refs

(Contract NAS8-20150)

(NASA-CR-77499; U-3637) CFSTI: HC $3.00/MF $0.75 CSCL 22C

The problems of steering a vehicle from a circular orbit about one planet to a circular orbit about another planet using low thrust acceleration is discussed. It is shown that a complete picture of the interplanetary transfer problem can be formed using the energy-momentum diagram to link segments of constant thrust acceleration at fixed steering angles with a coast segment. Contours of constant characteristic velocity, the optimum steering combinations, and the corresponding characteristic velocity requirements are presented. Analytical methods for giving low thrust planetary escape and capture spirals are evaluated and treated numerically. The problems of correcting the direction of the escape asymptote, and of steering to a circular orbit starting from off-nominal conditions at capture are described. Difficulties arising because the interplanetary phase and the capture phase are linked by a transition region in which the solar and planetary attractions are on the same order is also discussed. N.E.N.

N66-35309*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CONDITIONS OF ENCOUNTER BETWEEN DUST AND THE PLANTERS

Curtis W. Mc Cracken [1965] 30 p refs Submitted for Publication

(NASA-TM-X-57009) CFSTI: HC $2.00/MF $0.50 CSCL 03B

The conditions of encounter between interplanetary dust particles and the planets are investigated for the range of particle size where the force of solar radiation is not negligible in comparison with the force of solar gravity. The action of solar radiation pressure in reducing the heliocentric orbital speed of a small dust particle makes possible very low planetocentric speeds at encounter for an entire class of heliocentric orbits of non-zero eccentricity and fairly low inclination. The speed at encounter and the apparent radiant depend on the size of the dust particle for a given heliocentric orbit throughout the range of particle size being investigated by means of dust particle sensors mounted on spacecraft. Author

N66-35314*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GO, NO-GO FOR THE APOLLO SPACECRAFT—AN ANALYTICAL SOLUTION

F. O. Vonbun [1965] 17 p refs Submitted for Publication

(NASA-TM-X-56989) CFSTI: HC $1.00/MF $0.50 CSCL 22A

A simple expression for the go, no-go criterion is derived in analytical form. This provides a better understanding of the problems involved which is lacking when large computer programs are used. Comparitive "slide rule" results and computer results are included. An example is given using a 185 km near circular parking orbit. It is shown that a 3σ speed error of 6 m/s and a 3σ flight path angle error of 4.5 mrad result in a 3σ perigee error of 30 km which is tolerable when a 5 day orbital life time of the Apollo (SIVB + Service + Command Module) is required. Author

N66-35318*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

THE SEMICONVECTIVE ZONE IN VERY MASSIVE STARS

Richard Stothers [1965] 29 p refs Submitted for Publication

(NASA-TM-X-56962) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Models are constructed for very massive stars in the range 45 M. to 1000 M. during hydrogen burning, in order to examine the role of convective instability. The semi-convective zone shows a maximum growth (in mass fraction) at about 60 $M_\odot$, with a chosen initial hydrogen abundance of X=0.70. Sixty $M_\odot$ is also the maximum mass found by Schwarzschild and Harm to be stable against radial pulsations, for nearly the same chemical composition. Radiation pressure has a critical destabilizing influence here. In the limit of the highest masses, the semi-convective zone disappears toward the surface, but the star still evolves inhomogeneously. It is shown that asymptotic limits at hydrogen exhaustion exist for the mass fraction of the convective core, the mean hydrogen content, and the hydrogen-burning lifetime. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-34323*# National Aeronautics and Space Administration, Washington, D. C.

AEROBEE 350 PASSES TEST WITH PAYLOAD

17 Aug. 1966 3 p

(NASA News Release-66-221) Available from the Scientific and Technical Information Division CSCL 22D

Launching of the Aerobee 350 high-performance research rocket from the NASA Wallops Station is reported. Main purpose of the launch was to evaluate performance of the rocket. Characteristics, scientific instrumentation, performance data, and background information are briefly given. Also contained are data of the solid-fuel Nike booster. K.W.

N66-34340# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

MANKIND'S GREAT ACHIEVEMENT; FIRST AUTOMATIC LUNAR STATION

1966 16 p Transl. into ENGLISH from Prauda (Moscow), no. 37(17354), 6 Feb. 1966

(TC-1005; TT-66-61193; AD-632203) CFSTI: HC $1.00/MF $0.50

Events leading to the soft landing on the moon of Luna 9, the Soviet automatic lunar station, are detailed; and various characteristics of the station are given. Corrections necessary once Luna 9 was on its journey are described, along with special preparations required for the landing itself. A general discussion is included of the significance of the landing. M.W.R.

N66-34368*# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.

PRINCETON ADVANCED SATELLITE STUDY Final Report, 8 Mar. 1965–15 May 1966

W. F. Loening and H. S. Hemstreet [1966] 584 p refs Prepared for Princeton Univ. Obs.

(Grant NGR-31-001-044)

(NASA-CR-75294) CFSTI: HC $6.22/MF $2.75 CSCL 22B

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PRINCETON ADVANCED SATELLITE STUDY

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2. VOLUME II: GENERAL PROBLEMS ASSOCIATED WITH SPACEBORNE TELESCOPES 87 p refs (See N66-34370 20-23)
3. VOLUME III: 40-INCH SYSTEM DESCRIPTION 231 p refs (See N66-34371 20-31)
4. VOLUME IV: OAO/APEP IN ASSOCIATION WITH AAP 180 p refs (See N66-34372 20-31)

N66-34369*# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.

PRINCETON ADVANCED SATELLITE STUDY. VOLUME I: SUMMARY

In its Princeton Advanced Satellite Study [1966] 36 p (See N66-34368 20-31) CFSTI: HC $6.22/MF $2.75

(Rept.-8346(I))

Factors most likely to compromise the resolution capability of a large aperture telescope were analyzed and are presented. Selective evaluation of mirror materials established silicon for best temperature distribution, fused silicon for best expansion coefficient, and beryllium for best rigidity characteristics. The relative susceptibilities of the various mirror materials and configurations were compared by elastic strain testing, plastic strains during launch, and thermal strain and long-term dimensional changes during operation. Theoretical pointing accuracies were calculated from the stellar magnitude, aperture diameter, and system bandwidth. A 40-inch diameter magnetically suspended Cassegrain telescope in conjunction with two Vidicons for high-resolution spectrophotometry and diffraction-limited imagery in the visible and UV spectral regions evolved as most advanced optical system for an OAO spacecraft. G.G.

N66-34371*# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.

PRINCETON ADVANCED SATELLITE STUDY. VOLUME III: 40-INCH SYSTEM DESCRIPTION

In its Princeton Advanced Satellite Study [1966] 231 p refs (See N66-34368 20-31) CFSTI: HC $6.22/MF $2.75

(Rept.-8346(III))

Described is the 40-inch telescope system, designed for high resolution spectrophotometry as well as diffraction limited imagery, that fits into the same outer vehicle used for the Orbiting Astronomical Observatory series of satellites. Its primary data transducers consist of two vidicons arranged in a redundant configuration; orientation is controlled by magnetic pushers. During launch, the system package is separated into the instrument package, the primary mirror, and the secondary mirror support system. The telescope's 40-inch aperture Cassegrain design with a fast f/2 primary and a relatively strong secondary, results in a very compact design with an f/10 image plane about 10 inches behind the primary. A three-element refractive corrector extends the useful field to 30 minutes of arc diameter in the visible region. Design efforts centered primarily on establishing stability; no detailed analyses on the size and shape of the various structural members able to withstand launch acceleration was performed. G.G.

N66-34372*# Perkin-Elmer Corp., Norwalk, Conn.

PRINCETON ADVANCED SATELLITE STUDY. VOLUME IV: OAO/APEP IN ASSOCIATION WITH APP

In its Princeton Advanced Satellite Study [1966] 180 p refs (See N66-34368 20-31) CFSTI: HC $6.22/MF $2.75

The association of an Orbiting Astronomical Laboratory and an Apollo Applications Program vehicle to obtain scientific data in the visible and ultraviolet parts of the spectrum by utilization of a 40-inch, diffraction-limited, Cassegrain telescope was analyzed and design criteria were identified. The mission was defined by considering selection of orbital altitude and inclination, evaluation of launch vehicle compatibility, mode of operation, definition of man's role and of mission profile. The spacecraft was defined by evaluation of a typical OAO/APEP/AAP configuration, compatibility with Saturn launch environment, required OAO modifications, weight, and assisment of reliability. G.G.

N66-34409# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SATURN V LOW GRAVITY FLUID MECHANICS PROBLEMS AND THEIR INVESTIGATION BY FULL-SCALE ORBITAL EXPERIMENT

Frank E. Swalley, Gordon K. Platt, and Leon J. Hastings *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer Under Low Gravity [1966] 25 p refs (See N66-34408 20-12) CFSTI: HC $7.70/MF $2.25

Described are the low-gravity fluid mechanics problems of the Saturn V/S-IVB stage, which must coast for an extended period in earth orbit and then restart to place the Apollo into translunar coast. Also described is the Saturn IB liquid hydrogen orbital experiment planned to verify the Saturn V/S-IVB propellant ullaging and orbital venting system. The anticipated problems of the S-IVB arise primarily from the need to vent the liquid hydrogen tank due to boiloff, and constant control of the propellant was proposed. A system for constant positive

acceleration of the S-IVB vehicle was designed. In orbit, the vented hydrogen gas is utilized to provide a minimum acceleration of 2×10^{-5}g. At injection into orbit, severe dynamic effects are expected due to fluid motions established during ascent flight, and baffles or other control devices are proposed to prevent fluid from covering the vent exits for an extended period. The disturbances during orbital coast, which are slight as compared with those at injection, are caused by the operation of the attitude control system and the dynamic effects associated with venting. An approved full-scale orbital experiment to insure successful operation of the Saturn V/S-IVB is discussed. A TV system and additional instrumentation for propellant monitoring are mentioned. Author

N66-34857*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT PARAMETERS AND VEHICLE PERFORMANCE FOR PROJECT FIRE FLIGHT II, LAUNCHED MAY 22, 1965
John H. Lewis, Jr. and William I. Scallion Washington, NASA, Aug. 1966 106 p refs
(NASA-TN-D-3569) CFSTI: HC $2.50/MF $0.75 CSCL 22B

Project Fire was undertaken by the National Aeronautics and Space Administration to investigate the heating environment of vehicles entering the earth's atmosphere at velocities slightly higher than those associated with the return from a lunar mission. The second and final flight successfully placed a blunt-nose reentry vehicle into the desired reentry environment. A description of the flight and spacecraft performance is presented. Data from the tracking facilities were utilized to define the reentry trajectory. Sufficient data were obtained from tracking facilities and onboard systems to permit an accurate assessment of vehicle performance, activation of events, and the characteristics of the atmosphere through which the experiment was conducted.

N66-34861*# National Aeronautics and Space Administration, Washington, D. C.
GEMINI II
2 Sep. 1966 69 p
(NASA News Release-66-226) CFSTI: HC $3.00/MF $0.75 CSCL 22B

Background data are presented on launch of the Gemini II and its Agena Target Vehicle. Preflight activities, and integrated launch vehicle countdown are reported; a timetable is presented on reentry procedure. The overall mission description includes details on: launch, rendezvous, docking, extravehicular activity, docked Agena primary propulsion system, separation, and retrofire maneuver. Descriptions of 12 mission experiments are detailed. Provisions for crew consist of medical checks, flight menu, water measuring system, and body waste disposal. Mission requirements for the manned space flight tracking network, and ground communications are discussed, as are crew safety, planned contingency landing areas, abort, and recovery procedures. Specifications are given for the Gemini spacecraft and launch vehicle, Agena target vehicle, and the Atlas launch vehicle. Included are crew biographies, and data on previous Gemini flights. R.L.I.

N66-35090# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
THE FLIGHT OF AUTOMATIC INTERPLANETARY STATIONS VENUS-2 AND VENUS-3 [OPOLETE AVTOMATICHESKIKH MEXHPLANETNYKH STANTSIY VENERA-2 I VENERA-3]
May 1966 16 p Transl. into ENGLISH from Ekon. Gaz. (Moscow), no. 10, Mar. 1966
(ACIC-TC-1033; TT-66-61646; AD-634931) CFSTI: HC $1.00/MF $0.50

Translation of Russian articles: Flight of Automatic Interplanetary Stations 'Venus-2' and 'Venus-3'. TAB

N66-35193# Radio and Space Research Station, Slough (England).
WORLD DATA CENTRE C: ROCKETS AND SATELLITES LIST OF REPORTS AND REPRINTS RECEIVED DURING THE PERIOD 1st JANUARY, 1966–30th JUNE, 1966
[1966] 18 p refs
CFSTI: HC $1.00/MF $0.50

A bibliography is presented on topics related to satellites, probes, and rockets. The areas include space research, paths, tracking, data recovery, instrumentation, applications, interplanetary probes, gravitational and magnetic fields, radiation, atmosphere and ionosphere, radiowave propagation, meteors, and astronomy. N.E.N.

N66-35199# Joint Publications Research Service, Washington, D. C.
WEATHER SATELLITES: SOVIET VIEWS AND DEVELOPMENTS
Ye. Fedorov 29 Aug. 1966 13 p Transl. into ENGLISH from Izv. (Moscow), 21 Aug. 1966 5 p
(JPRS-37295; TT-66-33724) CFSTI: $1.00

The Cosmos 122 instrumentation, type of data, and data processing is reviewed. The cloud photographs taken with visible and infrared light, and radiation intensity measurements are described. The positioning of the instruments, visual analysis, and use of computers are mentioned. The future development of instruments and satellite stations for meteorological data collecting and atmospheric research are indicated. N.E.N.

N66-35223*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERO-ASTRODYNAMICS CONSIDERATIONS FOR THE APOLLO TELESCOPE MOUNT
Robert E. Lavender 8 Aug. 1966 96 p refs
(NASA-TM-X-53500) CFSTI: HC $2.50/MF $0.75 CSCL 22B

This report presents the results of preliminary analyses which have been conducted on the Apollo Telescope Mount (ATM). The ATM is an experimental package consisting of a group of sensors in the visual, ultraviolet (UV), extreme ultraviolet (XUV), and X-ray spectral regions, and the necessary experimental support equipment to obtain scientific data by solar observations from earth orbit. The ATM package is considered to be hard-mounted to the Lunar Module (LM). Mission analysis, orbital aerodynamics, aerodynamic torque, orbital lifetime, dynamics, and control are discussed. Preliminary mission timelines are included. Author

N66-35324*# National Aeronautics and Space Administration, Washington, D. C.
NASA TO LAUNCH 5th SCOUT REENTRY HEAT EXPERIMENT
28 Jan. 1966 13 p
(NASA News Release-66-18) Available from the Scientific and Technical Information Division CSCL 22B

The launching of a Scout vehicle flight experiment to determine how well phenolic nylon spacecraft heat shield material performs under actual reentry conditions is reported. Included are background data on the tracking and telemetry systems employed in the experiment, and a brief description of the Scout launch vehicle. S.C.W.

N66-35326*# National Aeronautics and Space Administration, Washington, D. C.
FIRST APOLLO SPACE TEST SET FOR FEB. 23
17 Feb. 1966 53 p
(NASA News Release-66-32) Available from the Scientific and Technical Information Division CSCL 22B

A narrative account of the unmanned Apollo mission describing the two-stage Saturn 1B launch vehicle is presented. Brief summaries of the flight plan, abort sequence, mission

control and tracking, and recovery operations are included. Descriptions of the command module, service module, and lunar excursion module are presented; however, the lunar excursion module is not included in this mission. Major Apollo systems are listed as well as camera operation aboard the spacecraft. S.P.

N66-35327*# National Aeronautics and Space Administration, Washington, D. C.
GEMINI 8 LAUNCH SET FOR MARCH 15
11 Mar. 1966 110 p
(NASA News Release-66-52) Available from the Scientific and Technical Information Division CSCL 22B

Background information is presented on the Gemini 8 launch, along with biographical data on the crew and a review of previous Gemini flight accomplishments. Preflight activities are discussed, and the launch vehicle countdown is listed. The mission profile presented is based on a normal mission, and covers launch, rendezvous, docking checks, extravehicular activity, re-rendezvous, final separation, Agena activities following rendezvous, retrofire, orbits, and proposed Gemini 8 and Agena maneuvers. Details are given on the four technological, five scientific, and one medical experiment plans. Crew provisions and training are discussed, along with the abort and recovery systems to insure crew safety. The Manned Space Flight Tracking Network is considered in relation to the Gemini 8 mission requirements. Descriptive data are also provided on the spacecraft and launch vehicles systems. M.G.J.

N66-35328*# National Aeronautics and Space Administration, Washington, D. C.
U.S. TO LAUNCH MOST ADVANCED UNMANNED SPACECRAFT
20 Mar. 1966 53 p
(NASA News Release-66-60) Available from the Scientific and Technical Information Division CSCL 22B

Characteristics of the first of four Orbiting Astronomical Observatories (OAO) carried by the Atlas-Agena launch vehicle are described. Various systems in the OAO-A1 such as attitude control, communications, data processing, power supply, and thermal control are reviewed. Gamma ray and X-ray scientific experiments assigned to OAO-A1 are mentioned. The Atlas-Agena D launch vehicle is described with particular attention to the Agena stage, the OAO shroud, and the flight plan. Ground operations are also discussed. S.P.

N66-35329*# National Aeronautics and Space Administration, Washington, D. C.
CENTAUR DEVELOPMENT FLIGHT SCHEDULED FOR LAUNCH MARCH 29
24 Mar. 1966 23 p
(NASA News Release-66-58) Available from the Scientific and Technical Information Division CSCL 22B

General information is offered on the Atlas-Centaur launch vehicle, and the AC-8 mission. The purpose of this mission is to demonstrate Centaur's capability to restart its high energy engines in the space environment following a coast period in Earth orbit. The test objectives are outlined, and the future uses of the launch vehicle in the Surveyor and Mariner 1969 missions are discussed. H.S.W.

N66-35330*# National Aeronautics and Space Administration, Washington, D. C.
ROUND-THE-CLOCK WEATHER PHOTOS DUE FROM NIMBUS
24 Apr. 1966 81 p
(NASA News Release-66-80) Available from the Scientific and Technical Information Division CSCL 22B

An informative discussion is presented of the butterfly-shaped Nimbus-C weather-watching satellite. If orbited as planned, instantaneous, around the clock weather photographs will be available. General background data is provided on the spacecraft's systems and subsystems, the meteorological experiments to be conducted, and the data acquisition and data utilization facilities. H.S.W.

N66-35331*# National Aeronautics and Space Administration, Washington, D. C.
INITIAL TOS LAUNCHING SCHEDULED FEBRUARY 2
30 Jan. 1966 17 p Prepared Jointly with Environ. Sci. Serv. Admin.
(ES-66-7) Available from the Scientific and Technical Information Division CSCL 22B

The objectives of the TIROS operational satellite (TOS) system are discussed, and a technical data summary is given on the Essa (environmental survey satellite). Designed for use by the Weather Bureau to improve daily weather analyses and forecasts, the information gathered by the satellites will also be transmitted to weathermen in other nations. Background information is provided on the spacecraft, the television cameras, data acquisition and analysis, the orbit, flight plan, stabilization and control subsystems, and the Delta launch vehicle. A recapitulation of the TIROS weather satellite record is included. M.G.J.

N66-35333*# National Aeronautics and Space Administration, Washington, D. C.
FIRST GLIDE FLIGHT OF HEAVY LIFTING BODY PLANNED SOON
26 Apr. 1966 23 p
(NASA News Release-66-89) Available from the Scientific and Technical Information Division CSCL 22B

A description of the first glide flight of the M2-F2 heavy lifting body is presented in a narrative account to establish a technological base for design of future manned reentry vehicles. Emphasis of the flight research program is placed on the final approach and landing, and the purpose of the 4-minute flight is to perform a complete design and systems checkout of the vehicle while evaluating stability and control. Background data on the concept of the lifting body are included. Brief descriptions are provided for such factors as dimensions, controls, landing gear, ballast tanks, ejection equipment, and landing rockets. S.P.

N66-35334*# National Aeronautics and Space Administration, Washington, D. C.
NASA TO LAUNCH ATMOSPHERE EXPLORER
5 May 1966 36 p
(NASA News Release-66-96) Available from the Scientific and Technical Information Division CSCL 22B

Atmosphere Explorer-B, the aeronomy spacecraft carrying experiments to measure temperatures, composition, densities, and pressures in the upper atmosphere on a global basis, is described in a narrative account. Scientific objectives are related; and various experiments with the ion mass spectrometer, neutral-particle mass spectrometer, density gages, and electrostatic probes are summarized. Day and night sensors and day-night switching detectors are discussed as part of the optical aspect system. Various other systems such as power supply, internal telemetry and data recording, spin-axis control, and spin-rate control are included. Characteristics of the three-stage Delta launch vehicle are related, and tracking stations are listed. S.P.

N66-35335*# National Aeronautics and Space Administration, Washington, D. C.
GEMINI 9 LAUNCHES SET MAY 17
10 May 1966 73 p
(NASA News Release-66-97) Available from the Scientific and Technical Information Division CSCL 22B

An account is given of the Gemini 9 mission, from its scheduled launch no earlier than May 17, 1966, to splashdown at the beginning of the 45th revolution. Two types of rendezvous operations are planned for the mission in addition to seven additional experiments. Scientific experiments include zodiacal photography, two meteroid collection experiments, and airglow horizon photography. Technological experiments are UHF/VHF polarization and the Astronaut Maneuvering Unit. The medical experiment is the bioassays of body fluids. Additional information is given on crew training and provisions, the space flight tracking network, abort and recovery procedures, and the spacecraft and launch vehicles. H.S.W.

N66-35336*# National Aeronautics and Space Administration, Washington, D. C.
NASA SCHEDULES SECOND IN NEW PIONEER SERIES
11 Aug. 1966 43 p
(NASA News Release-66-211) Available from the Scientific and Technical Information Division CSCL 22B

Comments are made on the data expected to be received from the Pioneer B spacecraft. It will be launched into orbit around the Sun and will pass close to the Sun-Earth line, where it may detect the Earth's magnetosphere tail. Observations of atomic and sub-atomic particles and magnetic fields will be coordinated with other NASA spacecraft to gather data continuously from events on a strip of the solar surface extending nearly half way around the Sun. A general discussion is provided of the spacecraft configuration, the scientific investigations to be conducted, the Delta launch vehicle, and the flight plan. If successfully launched, Pioneer B will be renamed Pioneer VII. H.S.W.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-34127*# Rohr Corp., Chula Vista, Calif.
SOME DESIGN CONSIDERATIONS FOR ADHESIVE BONDING
Edward C. Burkart *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 19 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

This paper covers some of the design details and materials selection criteria which are important considerations for the designer of bonded structures. The advantages and limitations of bonded structures are discussed, along with design suggestions for better utilization of the bonded concept. A comparison between adhesive bonding and mechanical fastening is made in several standard types of construction. The basic concepts of a bonded sandwich are discussed relative to optimizing from both functional and manufacturing standpoints. Suggestions are given for insuring the compatibility of the various elements of a sandwich structure through the proper selection of materials and design configuration. Also included is a brief description of a program presently in existence which investigates the feasibility of substituting adhesive bonding for mechanical fasteners on large rocket thrust structures. Author

N66-34128*# General Dynamics/Fort Worth, Tex.
DESIGN OF HEAVY-GAGE BONDED HONEYCOMB SANDWICH
Charles F. Herndon *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 25 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

The confidence and knowledge which exists in heavy-gage sandwich technology is the major theme of this paper. It can be shown that, with caution and discrimination at various design points, heavy-gage sandwich can be approached in a way to avoid encountering major problems. Some of the key potential problem areas are associated with adhesive selection and the definition of joint concepts. Even though the majority of the bonded surface area is over honeycomb core, the decisions regarding the designs and adhesives at the edgemembers are so important that they may determine the success of a heavy-gage sandwich design. Author

N66-34129*# Goodyear Aerospace Corp., Akron, Ohio.
DESIGN OF THICK HONEYCOMB CORE STRUCTURES
C. A. Haudenchild *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 20 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

The demand for weight reduction in flight vehicles suggests the use of light-weight sandwich structures. Several factors must be considered to obtain minimum-weight sandwich constructions. High-strength thin facings combined with lightweight thick core can offer a highly efficient structure when careful consideration is given to practical proportions between facings and core, edge design details, and manufacturing techniques. This paper discusses design approaches to relatively thick-core sandwich constructions. A large cylindrical structure subjected to axial compression loading and panel-type structures requiring low deflection under transverse loads are briefly analyzed. The selection of structural adhesives for thick-core structures and manufacturing considerations also are discussed. Author

N66-34134*# Lockheed Missiles and Space Co., Palo Alto, Calif. Materials Science Lab.
APPLICATION OF AN ADHESIVELY BONDED CRYOGENIC INSULATION SYSTEM
John B. Rittenhouse *In* NASA Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 25 p (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00
(Contract NAS3-4199)

A materials and processing technique has been developed for the successful adhesive bonding of a cryogenic insulation system to the 2219T 87 aluminum alloy welded liquid hydrogen vessel for the Saturn V Apollo system. The materials and processing variables in the development of this cryogenic insulation system have been worked out for the adhesive bonding, the insulation materials system, the structural support system, through design analysis, laboratory testing of materials, and fabrication and testing of a subscale cryogenic tank. The design analysis trade-offs in the selection of the double aluminized Mylar–Dexiglass spacer system, with button retainers mounted over a helium purged fiberglass adhesively bonded substrate as opposed to the crinkled aluminized Mylar shingle system are discussed. Installed system weight, ascent, and space mission boil-off characteristics were developed analytically for these systems. Laboratory cryostat data were used to support and verify the analytical procedures. For the test program it was necessary to adhesively bond platinum resistance thermometers and pressure transducer with their associated wiring to the test vessel interior. It was also necessary to bond thermocouples and transducer to the tank exterior and to several layers of the insulation materials system. The techniques for successfully accomplishing this task to assure accurate test results are also discussed. Author

N66-34138*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
DEVELOPMENT OF A BONDED COMMON BULKHEAD FOR SATURN

A. C. Robertson and E. L. Brown (NASA. Marshall Space Flight Center) *In* NASA. Marshall Space Flight Center Structural Adhesive Bonding Conf. 14 Mar. 1966 30 p *Its* Paper No. 3817 (See N66-34126 20-15) CFSTI: HC $7.00/MF $2.00

The fabrication of common bulkheads for Saturn vehicles (S-II, S-IV, and S-IVB) is complex and difficult to control. The bulkheads are a sandwich structure composed of aluminum alloy skins bonded to fiberglass honeycomb core. Therefore, a development program to simplify and improve the manufacture of these critical Saturn components was initiated. One approach selected for investigation was the use of bonding rather than welding to join the aluminum skins. Although a bonding material suitable for use at LH_2 temperatures has been available for several years, its use has been restricted primarily to so-called non-structural applications—clips, brackets, etc. Its use to join primary structural components offers not only potential simplifications in fabrication but significant improvements in the repairability and replaceability of structure. This paper describes the development and fabrication of an experimental Saturn S-IV common bulkhead using this adhesive. Author

N66-34138*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INSPECTION OF HONEYCOMB STRUCTURES USING BI-REFRINGENT PLASTIC COATINGS

Hill M. Walker *In its* Structural Adhesive Bonding Conf. 14 Mar. 1966 30 p (See N66-34126 20-15) CFSTI: HC $7.00/

In response to the urgent need for more and better methods for determining the integrity of bonded honeycomb sandwich structures, a technique has been devised whereby bond defects in the core-to-skin interface can be detected by simple, visual observation, without relying on expensive equipment or sophisticated operator technique. This inspection device involves the application of a transparent plastic film, employed in conventional photo elastic stress analysis investigations, to the surface of the honeycomb panel skin. Areas over defective bonds are caused to deflect outward by application of air pressure to the sealed, perforated core volume. These deflections carry through to the plastic surface film, causing peripheral strains which become visible when illuminated and viewed (or photographed) through polarized filters. Effectiveness of the techniques is dependent upon the proper interrelationship among the affecting variables of void size, skin thickness, coating thickness, and internal pressure applied. Author

N66-34158# Army Materials Research Agency, Watertown, Mass.

ASYMPTOTIC ANALYSIS OF THE AXISYMMETRIC VIBRATIONS OF SHELLS

Edward R. Rose, Jr. Jun. 1966 15 p refs Presented at the Army Sci. Conf., West Point, N. Y., 14–17 Jun. 1966
(AD-634635) CFSTI: HC $1.00/MF $0.50

The paper describes an attempt to apply asymptotic theory to a class of problems in shell dynamics, namely, finding the solutions, for elastic, axisymmetric shells executing simple harmonic axially symmetric vibrations. The purpose of the investigation is to obtain approximations to the general solutions of the governing system learn about the general properties of these solutions. Author (TAB)

N66-34201# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.

STUDY OF MARINE RECUPERATORS Quarterly Progress Report, 1 Jan.–31 Mar. 1966

[1966] 8 p
(Contract NObs-92558)
(AD-634901) CFSTI: HC $1.00/MF $0.50

During this period the test facility was nearly completed. Four test modules out of thirty-one have been completed and facility shakedown is underway. Author (TAB)

N66-34207*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

INVESTIGATION OF JUNCTURE STRESS FIELDS IN MULTICELLULAR SHELL STRUCTURES

E. Y. W. Tsui, F. A. Brogan, J. M. Massard, P. Stern, and C. E. Stuhlman Feb. 1964 173 p refs
(Contract NAS8-11079)
(NASA-CR-61050) CFSTI: HC $3.25/MF $1.25 CSCL 20K

The discontinuity stress fields that arise in thin elastic multicellular shell structures subjected to inertial, pressure, and thermal loading conditions in combination with residual stresses resulting from fabrication and assembly were investigated using numerical techniques. The structure was first analyzed in terms of the behavior of the simple elements, cone, sphere, cylinder, and plate, as represented by stiffness matrices which relate the boundary forces on the element to boundary displacements. Using this and and the necessary conditions of equilibrium and displacement compatibility between elements, a set of equations was formed and solutions obtained for the actual element displacement boundary values corresponding to the continuous structure. The stress through the various elements were next determined from the stiffness functions. The stiffness matrices for the individual shell elements were determined through the finite difference reduction of the shell equations. A direct method was developed to solve large sets of algebraic equations accurately and in reasonable computer time. N.E.N.

N66-34218# Army Foreign Science and Technology Center, Washington, D. C.

THE REFINEMENT OF THE CLASSICAL FLEXURE THEORY OF ANISOTROPIC PLATES

L. A. Agalovyan Jun. 1966 21 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Fiz.-Mat. (Yerevan), v. 17, no. 5, 1965 Presented at 5th All-Union Conf. on the Theory of Shells and Plates, Moscow, 3–6 Feb. 1965
(FSTC-HT-23-94-66; TT-66-61516; AD-634416) CFSTI: HC $1.00/MF $0.50

The flexure theory of anisotropic thin plates is established without using any of the assumptions of the classical flexure theory. The asymptotic integration method allows the splitting of the stressed state solution into a sum of three terms. The first term is determined by the basic iteration-process which does not include damping of the boundary stress effects, while the two additional damping-containing terms are supplied by auxiliary process evaluation. The resulting integrals incorporate a sufficient degree of arbitrariness to be able to satisfy all boundary conditions. Author (TAB)

N66-34221# Allied Research Associates, Inc., Concord, Mass.

A PHOTOELASTIC INVESTIGATION OF DEEP SUBMERGENCE WINDOWS

Robert Winter and Herbert Becker May 1966 54 p refs
(Contract NObs-94102)
(ARA-315-7; AD-634403) CFSTI: HC $3.00/MF $0.50

Photoelastic investigations were conducted to determine stresses in 45° seat angle conical frustum plastic windows with diameter/thickness (D/H) ratios from 0.5 to 2.5 to embrace the range of current design (on Aluminant, Trieste, and Alvin vehicles, D/H=0.54, 0.67, and 1.43 respectively). The results indicate that a window with D/H less than 1 may be used without significant tensile stresses occurring on the inner face. The effect of seat angle/window angle mismatch was found to have relatively little effect upon stress levels near the cone axis, although local concentrations at the periphery of the inner face were strongly affected. An important aspect of the study was the tentative identification of the physical nature of the window behavior as a conical sector of a pressurized hollow sphere interacting with a lens shaped cap. Author (TAB)

N66-34238# Brown Univ., Providence, R. I. Div. of Engineering.

DESCRIPTION OF MECHANICAL BEHAVIOR OF INELASTIC SOLIDS

E. T. Onat May 1966 25 p refs

(Contract DA-19-020-AMC-0077(R); ARPA Order 71)

(TR-6; AD-634702) CFSTI: HC $2.00/MF $0.50

The paper is concerned with the representation of mechanical behavior of non-linear solids with memory. The nature and limitations of integral representation of Frechet are discussed. Definitions of state and state variables, which are based on observable histories, are introduced. These notions give rise to differential equation representation of behavior discussed in the latter part of the paper. Author (TAB)

N66-34259# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STABILITY OF SYSTEMS POSSESSING PROPERTIES OF CREEP

A. R. Rzhanitsyn 15 Feb. 1966 22 p refs Transl. into ENGLISH of All-Union Conf. on Theory of Calculations on Creep and Rupture Strength, Novosibirsk (USSR), 15–18 May 1962 Novosibirsk, Publishing House of Siberian Sect. of Acad. of Sci., 1963 p 15–38

(FTD-MT-65-171; AD-634833) CFSTI: HC $1.50/MF $0.50

Translation of Russian research: stability of systems possessing properties of creep. (TAB)

N66-34377# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TRANSACTIONS OF THE SCIENTIFIC AND TECHNICAL CONFERENCE ON THE DAMPING OF VIBRATIONS

15 Mar. 1966 243 p refs Transl. into ENGLISH of the book "Trudy Nauchno-Tekhniches kogo Soveschchaniya po Dempfirovaniyu Kolebaniy" Kiev, Izd. AN Ukr. SSR, 1960 p 1–180 Conf. held 17–19 Dec. 1958

(FTD-MT-64-507; TT-66-61396; AD-633644) CFSTI: HC $6.00/MF $1.25

Conference papers on theoretical and experimental investigations of energy dissipation during mechanical vibrations are presented. For individual titles see N66-34378–N66-34404.

N66-34378# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SURVEY OF WORKS ON THE STUDY OF DAMPING OF VIBRATIONS MADE AT KIEV

G. S. Pisarenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 1–18 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

An overview is presented of research dealing with damping of vibrations, beginning with studies of energy dissipation started at Kiev in 1939. It is noted that at first energy dissipation was examined from the point of view of mechanics; in more recent years the emphasis has been vibrations in a material, with considerably less attention to external losses. Because of the earlier theoretical calculations made, it has been possible to deal with subjects such as (1) longitudinal vibrations of a prismatic rod, (2) longitudinal vibrations of helical springs (3) transverse vibrations of a graduated rod, (4) transverse vibrations of plates, and (5) the problem which arises on bending torsional free and forced vibrations. Experimental investigations show that energy dissipation in a given material is not a single-valued function of any one parameter; and these various factors are included in a logarithmic damping decrement. The method of excitation used in the study of damped vibrations is discussed, as is the development of equipment and some experimental results. M.W.R.

N66-34379# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LONGITUDINAL VIBRATIONS OF A ROD WITH HYSTERESIS LOSSES TAKEN INTO ACCOUNT

G. S. Pisarenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 19–27 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Equations are evolved to determine the longitudinal vibrations of an elastic rod; and the relationships between the stress and deformations, which result in the formation of a hysteresis loop, are taken into account. Boundary conditions and the constant of integration are determined, and the final formulas for determining both the amplitude and phase of the vibration of a section of a rod are presented. M.W.R.

N66-34380# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LONGITUDINAL VIBRATIONS OF HELICAL SPRINGS WITH THE DISSIPATION OF ENERGY IN THE MATERIAL TAKEN INTO ACCOUNT

G. S. Pisarenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 28–43 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Initial differential equations for vibrations of flat helical spring coils are derived, and equations are given for the cases involving both free and forced vibrations. Energy dissipation is taken into account in these nonlinear approximations for solving problems with hysteresis loops; and formulas are given for the construction of the resonance curve of vibrations of a helical spring. M.W.R.

N66-34381# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TRANSVERSE VIBRATIONS OF STEPPED BARS WITH THE HYSTERESIS LOSSES TAKEN INTO ACCOUNT

G. S. Pisarenko and N. I. Shchepetkina *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 44–56 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Formulas are derived for the computation of transverse vibrations in stepped bars with hysteresis loops. The bars consist of a number of steps of certain lengths, and each step has a constant section. Energy dissipation, bending of the bar, and hysteresis losses are taken into account in developing the initial differential equations. The function of deformation and the frequency of vibration are determined in a zero approximation, and applied to the examination of a two-step cantilever bar. Boundary conditions are introduced and the various integration constants are determined. The formula for a first approximation is also derived. A resonance curve is then constructed for a stepped bar; and it is noted that the nonlinearity increases due to internal losses in material which occur as deformation increases. M.W.R.

N66-34382# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON TAKING INTO ACCOUNT HYSTERESIS LOSSES DURING VIBRATIONS OF PLATES

G. S. Pisarenko and N. I. Shchepetkin *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 57–70 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

The nonlinear relationship between stress and relative deformation which results in a hysteresis loop is used to derive the fundamental equations for calculating the transverse vibrations in thin plates. The problem is solved in both a zero and first order approximation; the final differential equations of the first approximation include certain constant coefficients which result from the transformation after integration and accounting for boundary

conditions. The present results are for free vibrations, but a similar formula can be obtained for forced vibrations; also, it is mentioned that second approximation formulas are easily obtainable.
M.W.R.

N66-34383# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BENDING-TORSIONAL VIBRATIONS OF RODS WITH THE ENERGY DISSIPATION IN THE MATERIAL TAKEN INTO ACCOUNT
N. V. Vasilenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 71–87 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

The torsional vibrations which accompany bending vibrations of rods of asymmetric cross section are considered, and energy dissipation in the structural material is taken into account in the derivation of equations for determining these vibrations. Equations are evolved for forced bending-torsional vibrations with friction taken into account, as well as for free bending-torsional vibrations with damping. Consideration is then given to the calculation of frequencies of bending-torsional vibrations with friction ignored.
M.W.R.

N66-34384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF METHODS OF MATHEMATICAL STATISTICS TO AN ANALYSIS OF THE PROCESS OF DISSIPATION OF ENERGY IN A MATERIAL
V. T. Troshchenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 88–104 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

A mathematical expression is determined for the energy dissipated by a unit of material during one vibration cycle, based on the assumption that microplastic deformations cause this dissipation. It is shown that energy dissipation depends upon the structural properties of the materials, the dimensions of the test specimens, and the types of stress conditions; and methods to account for factors such as these are outlined. A review is included of some studies dealing with relationships between plastic deformations during tension and torsion.
M.W.R.

N66-34385# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON CERTAIN METHODS OF AN EXPERIMENTAL STUDY OF THE DISSIPATION OF ENERGY IN A MATERIAL DURING VIBRATIONS
V. G. Timoshenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 105–116 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Excitation of bending vibrations at low frequencies is discussed as a means of investigating the energy dissipation in a material subjected to vibration; and special consideration is given to the excitation of bending vibrations of rods of nonmagnetic material. An experimental apparatus is described, including the amplifier circuit for separate recording of simultaneous longitudinal and torsional vibrations.
M.W.R.

N66-34386# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NEW METHOD OF DETERMINING CHARACTERISTICS OF INTERNAL FRICTION
Z. A. Miskievich *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 117–121 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Characteristics of internal friction are determined by measuring the magnitude of dissipated energy during rotation of a thin-walled rod in a state of flexure. The apparatus has fixed bearings on two supports containing differential axles with heavy-balanced disks; and this permits loading with a bending moment which is constant in length. This apparatus permits testing of the material under uniform symmetric cycles, as well as the complete elimination of losses at the linkage point of the specimen being tested. Results are reported for steel 20, aluminum, and brass; and it is seen that there is an increase in dissipated energy with an increase in stress. Tests on simple linkage points are also mentioned, and it is noted that the friction in a structure is determined primarily by the friction at the fitting points rather than in the metal itself.
M.W.R.

N66-34387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALORIMETRIC METHOD OF STUDYING THE DISSIPATION OF ENERGY IN A MATERIAL DURING HIGH-FREQUENCY MECHANICAL VIBRATIONS
V. A. Kuz'menko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 122–125 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

A calorimetric method was used to make the necessary measurements of energy dissipation during high-frequency mechanical vibrations on specimens of steel (St. 30 and an alloy (EI-612) tested to determine the logarithmic decrement of their different stress levels. It was found that by increasing the amplitude of stresses in the steel specimen from 6 to 13 kg/mm^2 the logarithmic decrement increased from 0.6 to 1.2%; and these results are considered to agree with those obtained by other methods for other steels. For the alloy, logarithmic decrements of a stepped specimen vary from 0.10 to 0.15% as the amplitude stresses are increased from 21 to 27 kg/mm^2, which is also considered to agree with results obtained by other methods.
M.W.R.

N66-34388# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON DETERMINING THE LOGARITHMIC DECREMENT DURING FREE DAMPING VIBRATIONS
V. V. Khil'chevskiy *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 126–130 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

During an investigation of the influence of plastic deformation on energy dissipation in a material, it was found that logarithmic decrement increases as the stress is increased in subsequent trials. Results are given for an annealed steel (U-8) which is heated to 790° C and then cooled, as well as for the material when it is aged. It is noted that even though certain inconsistencies are found in the results, the treatment of the material determines its internal energy dissipation. The method of free damped vibrations is used in studying the phenomenon.
M.W.R.

N66-34389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON DETERMINING THE TRUE CHARACTERISTICS OF DISSIPATION OF ENERGY IN A MATERIAL DURING VIBRATIONS
V. A. Kuz'menko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 131–136 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

A method is described for the processing the results of measurements taken during vibration of a nonuniformly stressed specimen in order to determine the energy dissipation characteristics of the material. A rod of uniform cross section, vibrating longitudinally with a natural frequency, serves as an example. It is pointed out that the accuracy of the method is dependent upon the number of sectors into which the rod is divided for the processing of results, and that graphic representations are not a requirement of the method. The method is considered applicable to more complex stress conditions than that which exists in the example given.
M.W.R.

N66-34390# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INFLUENCE OF TYPE OF STRESS CONDITION ON THE DISSIPATION OF ENERGY IN A MATERIAL DURING VIBRATIONS

N. V. Novikov *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 137–147 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Longitudinal, torsional, and combined damping were investigated in steel specimens to determine energy dissipation under different stress conditions. Damping decrement is higher for torsional than longitudinal vibrations of corresponding frequencies, and the superposing of torsional vibrations of different stress amplitudes does not effect damping in longitudinal vibrations. On the other hand, superposing of longitudinal vibrations causes an increase in damping of torsional vibrations which corresponds to the increase in stress amplitude. To investigate energy dissipation during torsional vibrations of a circular solid specimen, an apparatus with resonance excitation of the vibration was used. It is noted that the damping ability of the circular specimen during torsional vibration is lower than that of a plane prismatic specimen during transverse vibrations. Damping of transverse vibrations of the circular specimen of steel 45 is less than that for the plane specimen, and this is considered related to the plastic deformation of the microvolume of the material. M.W.R.

N66-34391# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE INFLUENCE OF TYPE OF STRESS CONDITION ON THE DISSIPATION OF ENERGY IN A MATERIAL

V. V. Khil'chevskiy *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 148–151 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Data are given which show that an equality of energy dissipation can be obtained during flexure and torsion when the applied octahedral stresses are equal. Since an experiment for torsion is more easily conducted on circular specimens and study of flexure is better on plane or flat specimens, it was necessary to establish a cross section of a bent specimen to meet both needs; and the procedure for accomplishing this is outlined. Results are given for specimens of steel 40 and a steel with small parts of chromium, manganese, and phosphorus. M.W.R.

N66-34392# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE DISSIPATION OF ENERGY IN RODS DURING DIFFERENT MODES OF BENDING VIBRATIONS

A. P. Yakovlev *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 152–157 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Energy dissipation in two groups of prismatic rods made of cermet material is investigated; specimens with dimensions of 3.5×13×196 were investigated during first and second mode of transverse vibrations and those with dimensions of 4×15×295 mm during second and third modes. Results indicate that under the same maximum stress conditions, the logarithmic damping decrement decreases with an increase in order of vibration mode. Since the decrement is dependent upon the potential energy accumulated by the rod during vibrations, an expression is derived to determine the energy of a cantilever-inserted rod during bending vibrations. Equations are also evolved for obtaining mean areas of the hysteresis loop for the first four modes of vibrations of a prismatic rod. M.W.R.

N66-34393# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE INFLUENCE OF GEOMETRIC DIMENSIONS OF TEST SPECIMENS ON THE DISSIPATION OF ENERGY IN A MATERIAL DURING TORSIONAL VIBRATIONS

N. M. Mukhin *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 158–163 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Three series of experimental specimens were prepared to study the effect of their geometric dimensions on the dissipation of energy during torsional vibrations. These were: (1) carbon steel 45 with unbroken circular cross section, diameter of 8 to 50 mm, and effective length of 250 to 1000; (2) hollow tubular steel 45 with wall thickness of 2 mm, external diameter of 16 to 50 mm, and effective length of 400 to 1000 mm; and (3) chrome-nickel specimens of continuous circular cross section, diameter of 10 to 40 mm, and length of 200 to 1000 mm. The vibrostand used during the investigation is shown. It is shown that for all specimens the logarithmic damping decrement increases with an increase in diameter and decrease in length of the specimen. M.W.R.

N66-34394# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF INFLUENCE OF DIMENSIONS OF CERMET SPECIMENS ON LOGARITHMIC DAMPING DECREMENT DURING TRANSVERSE VIBRATIONS

A. P. Yakovlev and R. G. Shumilova *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 164–166 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

An investigation made on cermet prismatic rods of various sizes concludes that an increase of the geometric dimensions of the specimens by 2.5 results in an increase in the logarithmic damping increment by approximately 70%. A table gives the lengths, thicknesses, widths of working parts, and lengths and thicknesses of the thicker parts for each of the four types of specimens; and the method employed during the investigation is outlined. M.W.R.

N66-34395# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE ENERGY DISSIPATION IN HEAT-RESISTANT ALLOYS DURING VIBRATIONS AT HIGH TEMPERATURES

N. V. Novikov *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 167–171 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Damping ability is reported for four heat-resistant alloys used in the manufacturing of critical parts of turbomachines. It is shown that changes in temperature affect the damping ability of a material, although the curves representing these results vary for the four materials tested. For a steel designated EI-415, there is little effect at temperatures up to 300°C; a drop in damping decrement is seen by 500°C, with the sharpest sudden drop at 400°C; and with an increase to 550°C, the damping decrement sharply increases. For steel, EI-437B, almost the same pattern is noted, but for steels EI-788A and EI-817, there is a very steady increase of decrement with temperature increase. The anomalous changes in decrement exhibited by steels EI-415 and EI-437B at 400°C are attributed to physicochemical processes which occur within the metals, such as age-hardening and diffusion, which have a much greater influence than the rise in temperature itself. M.W.R.

N66-34396# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE INFLUENCE OF LOW TEMPERATURES ON THE DISSIPATION OF ENERGY IN A MATERIAL DURING TRANSVERSE VIBRATIONS

V. V. Khil'chevskiy *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 172–176 ref (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

An experimental investigation on the influence of low temperatures on energy dissipation during transverse vibrations in various metals and alloys concludes that, in most instances, there is little relationship. Two aluminum alloys, in particular, are shown to remain quite stable following exposure to vibrations at temperatures between +25° and −100°C. Similar results are obtained with steel, industrial aluminum, and copper; whereas decreases in damping decrements are noted for zinc and a magnesium alloy. M.W.R.

N66-34397# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DAMPING PECULIARITIES OF VIBRATIONS DURING TESTS OF FERROMAGNETIC SPECIMENS

M. A. Krishtal and S. A. Golovin *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 180–183 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Variation in damping ability of magnetized specimens of carbon steel was studied in relation to time under 17 kg/mm^2 torsional stress along the periphery. Relative damping is shown to follow a cyclical pattern; and for certain steel specimens magnetized to saturation, hardened, and tempered at 400°C, the cyclical changes are higher in magnitude and amplitude. While the relative damping is high, the cyclical function acquired an attenuating character after about six hours. M.W.R.

N66-34399# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN INVESTIGATION OF THE DAMPING OF FREE VIBRATIONS OF WIRE ROPES

I. Ye. Dobrivnyy *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 187–194 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Logarithmic damping decrements of vibrations for steel wire ropes are investigated in terms of amplitude of dynamic stress, magnitude of the end load, and modulus of elasticity for the ropes during use. It is shown that as the static stress is increased from zero to 3000 kg/cm^2, the decrement decreases on a linear basis to 50% of its original value as does the area of the hysteresis loop. Data indicate that an increase in stress has very little effect on the modulus of elasticity. M.W.R.

N66-34400# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF DAMPING VIBRATIONS OF PILES OF RODS

Ya. A. Bratus' and G. S. Pisarenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 195–206 (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

The damping abilities of piles of rods, both monoliths and riveted, are shown to depend on the flexural rigidity of the metal tape couplings; the greater the flexural rigidity, the smaller the ratio of the moment of inertia of the cross section of the (1) metal tape coupling to the (2) rod. Energy dissipation in monolith-piles results from losses in the tape and wire of the metal tape couplings; and logarithmic damping decrement in a pile with two couplings is twice that of one with a single coupling. If the coupling with low rigidity is removed from a two-coupling pile, there is a decrease in damping. In a pile with riveted metal tape, damping decrement is almost double that found in a nonriveted pile. The piles studied consisted of five, six, seven, or 10 steel rods. M.W.R.

N66-34401# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN INVESTIGATION OF THE VIBRATION STABILITY OF MECHANISMS WITH CYLINDRICAL SPRINGS DURING LONGITUDINAL FORCED VIBRATIONS

V. V. Gayun *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 207–211 ref (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Piezoelectric measurements of recording pressures were employed in an investigation of the vibration stability of mechanisms with cylindrical springs that were subjected to longitudinal forced vibrations. The stability criterion was taken as the lack of displacement of the mobile element in the mechanism. Error of recording pressure in the spring support was estimated to be between 10 and 15%, whereas error in recording vibration accelerations by a strain-gauge transducer was between 5 and 7%. Characteristics of the steel springs are tabulated and the methods used are detailed. It is noted that the method of coiling the last turns of the springs and the condition of their tightening greatly influence the development of resonance vibrations. M.W.R.

N66-34402# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON RESISTANCES DURING THE VIBRATION OF A SHIP HULL

N. N. Babayev, S. K. Dorofeyuk, and V. G. Lentyakov *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 212–220 ref (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Several ships and a special pontoon were tested with specially-designed vibration machines to determine damping decrements and dynamic factors which result from resonant vibrations. Damping decrements for vibrations of plates in ship hulls were found to vary from 0.035 to 0.05, and it is concluded that these figures show that total energy absorption during vibrations of ship plates is many times greater than the energy absorption caused by internal friction in the material itself. Horizontal vibrations of the hull, which usually correspond to significant torsional vibrations, do not have as great an effect as do vertical vibrations. It is, therefore, assumed that resistance to vibration of a ship hull does not depend entirely on the character of the deformations and is identical to flexure and shear. It is shown that energy absorption coefficients during vibrations of pontoon coverings are much greater than those for cantilever test pieces, and that greater energy losses can be expected in ship coverings. M.W.R.

N66-34403# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON ROLE OF INTERNAL FRICTION IN LIMITING RESONANCE TORSIONAL VIBRATIONS OF SHIP SHAFTINGS

F. F. Bolotin and I. A. Lur'ye *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 221–228 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Elastic hysteresis is considered to play a very small role in limiting the resonant torsional vibrations of ship shaftings, and damping is concluded to be chiefly concentrated in the engine itself. Methods for calculating these factors are discussed and explained; and, in view of the above findings, it is recommended that currently-used methods to measure resonance vibrations be re-examined. M.W.R.

N66-34404# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE INFLUENCE OF ELASTIC VIBRATIONS OF A BOLTED CONNECTION ON LOOSENING ITSELF

G. M. Ovsiyenko *In its* Trans. of the Sci. and Tech. Conf. on the Damping of Vibrations 15 Mar. 1966 p 229–234 refs (See N66-34377 20-32) CFSTI: HC $6.00/MF $1.25

Self-loosening of threaded bolt connections during vibration is attributed to joint openings at the connections, and a formula is evolved to determine the frequency with which opening can be expected to occur. It is noted that actual frequency values determined experimentally exceed calculated values by between 10 and 15%. Dissipation of energy during elastic vibration is given as the cause of joint opening and consequent thread self-loosening. M.W.R.

N66-34407*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A POWER-SPECTRAL-DENSITY COMPUTER PROGRAM FOR THE VIBRATION LABORATORY

C. P. Chapman 1 Aug. 1966 25 p

(Contract NAS7-100

(NASA-CR-77310; JPL-TR-32-993) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The computer program calculates vibration-acceleration densities (g^2/cps) at particular frequencies along power-spectral density (PSD) plots, and root-mean-square (rms) acceleration (g_{rms}) across the PSD-frequency spectra of random-noise test specifications. The most significant advantage of this computer program is its complete generality. It can be used to calculate g^2/cps and g_{rms} over any PSD specification without modification; only the data cards have to be changed. The output data from the computer program are used to verify the specification test levels and provide the theoretical PSD to obtain a spectra ratio for purposes of analysis on completion of displayed on a graph that illustrates in db the deviation from the specified g^2/cps at any frequency within the test-frequency spectrum. Author

N66-34466# Texas Univ., Austin. Electrical Engineering Research Lab.

PROPAGATION OF ELASTIC WAVES IN LAYERED MEDIA

Allan B. Schmitt and Francis X. Bostick, Jr. 15 May 1966 97 p refs

(Rept.-142; AD-633657) CFSTI: HC $3.00/MF $0.75

The fundamental stress-strain relationships are established and the necessary simplifying assumptions are introduced such as homogeneity, isotropy, etc. The equation of motion is derived and the elastic wave equations derived in terms of a displacement potential. The boundary conditions are established and example models are used to illustrate the distribution of energy associated with each type of wave. The ray path equations for horizontal and dipping layers are derived. It is shown how the nth layer parameters of wave velocity, layer depth, and dip of interface may be estimated if these parameters are known for the 1st, 2nd, . . . ,nth layers and the arrival times of a seismic wave reflected from the nth interface. The method is applied to actual seismic data obtained from Texas Instruments. Author (TAB)

N66-34467# Michigan Univ., Ann Arbor. Dept. of Civil Engineering.

BEHAVIOR AND MAXIMUM STRENGTH OF METAL COLUMNS Interim Report

Richard H. Batterman and Bruce G. Johnston May 1966 68 p refs

(Contract NBy-45819)

(Rept.-05154-2-T; AD-634495) CFSTI: HC $3.00/MF $0.75

By means of digital computer simulation the complete load-deformation history of a column was obtained. About one thousand simulation column tests provided a basis to establish systematically the maximum strength and study the behavior of both straight and initially crooked columns for various yield point steels and a typical aluminum alloy. The effects of residual stress, alone or in combination with initial crookedness, are systematically evaluated for steel columns. Author (TAB)

N66-34482# Marine Engineering Lab., Annapolis, Md.

MEASUREMENT OF COMPLEX SHEAR MODULUS OF VISCOELASTIC MATERIALS BY MECHANICAL IMPEDANCE METHODS

Andrew J. Roscoe, III, E. V. Thomas, and W. Blasingame May 1966 30 p refs

(MEL-238/66; AD-633772) CFSTI: HC $2.00/MF $0.50

The analytical prediction of damping performance as a function of frequency for laminated elastic-viscoelastic elastic beams has been quite accurately carried out by several investigators by assuming previous knowledge of dimensions, constants of elastic materials, and dynamic shear parameters of viscoelastic materials. One investigation has shown vast differences in the results of measurements of dynamic shear modulus of the same viscoelastic materials by different facilities. To increase the accuracy of analytical predictions of structural damping in U.S. Navy ships, there is a need for accurate measurement of complex shear modulus. This report describes an experimental method which uses mechanical impedance measurements on a laminated sandwich beam with a viscoelastic layer that is thin compared to the elastic layers to measure the complex shear modulus of the viscoelastic material. Results of using the method show that it provides an accurate and repeatable measurement. Author (TAB)

N66-34563# Lockheed Missiles and Space Co. Palo Alto, Calif. Research Lab.

EIGHT SAVINGS DERIVED FROM THE USE OF CONTRASTING MATERIALS IN CONVENTIONALLY STIFFENED CYLINDERS

A. Bruce Burns May 1966 37 p refs

(Rept.-6-76-66-2; AD-634140) CFSTI: HC $2.00/MF $0.50

A nondimensionalized structural optimization procedure is used to determine the effect on weight of specifying contrasting ring, stringer, and wall materials in j-stiffened, axially compressed cylinders, for conventional materials having modulus-to-density ratios of approximately 10^8 in. Lighter elastic designs result when less dense materials are introduced anywhere in the design, weight savings are proportional to the percentage of the lighter material used. However, since low-density materials usually have relatively low strengths, these materials are not efficient in plastic designs. Two nonconventional materials, beryllium and beryllium-38% aluminum, are studied in combination with aluminum. Aluminum rings may be used in otherwise beryllium or beryllium-38% aluminum designs with small weight penalties. At low loads, weights of designs with aluminum stringers and a beryllium or beryllium-38% aluminum wall, or vice versa, are about midway between the weights for all-aluminum and all-beryllium designs. At high loads, results depend heavily upon strength-density ratios. Author (TAB)

N66-34586# Polytechnic Inst. of Brooklyn, N. Y.

CREEP IN THE PRESENCE OF A LINE LOAD ON THE BOUNDARY OF AN INFINITE HALF-SPACE

B. Venkatraman May 1966 12 p refs

(Contract AF 49(638)-1360)

(AFOSR-66-0945; PIBAL-919; AD-635126) CFSTI: HC $1.00/MF $0.50

The plane strain problem of the creep of a semi-infinite solid subjected to a slanted line load on its horizontal boundary is considered in the present report. Closed form solutions are derived for creep stresses and displacements. Author (TAB)

N66-34593# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Mechanical Engineering.

AXISYMMETRIC VIBRATIONS OF HOMOGENEOUS AND SANDWICH SPHERICAL CAPS Scientific Report No. 7

Bernard Koplik and Yi-Yuan Yu Mar. 1966 52 p refs
(Contract AF 49(638)-1290)
(AFOSR-66-0582; AD-635133) CFSTI: HC $3.00/MF $0.50

From the generalized variational equation of motion is derived a complete system of equations for sandwich as well as homogeneous spherical shells including the effect of shear thickness-deformation. Based on these equations the exact solution is obtained for the natural frequencies of homogeneous and sandwich spherical caps with clamped edges. Emphasis in our investigation is on the transition from the vibrations of a circular disk to those of a spherical cap, for both homogeneous and sandwich cases, with numerical results showing the effect of thickness-shear and of curvature. An approximate solution is finally deduced from the exact solution. Author (TAB)

N66-34628*# California Univ., Berkeley. Structural Engineering Lab.
EQUATIONS FOR THERMOELASTIC AND VISCOELASTIC CYLINDRICAL SANDWICH SHELLS
Wolfgang J. Oberndorfer Mar. 1966 80 p refs */ts* Rept.-66-1
(Grant NsG-637)
(NASA-CR-77308) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Equations governing small deformation of a cylindrical sandwich shell are derived from the principle of Minimum Potential Energy. The facings are thin orthotropic shells with different physical properties and thicknesses, and a weak orthotropic core is considered. The effect of an arbitrary temperature distribution is included. Two examples are presented: (1) uniform heating of a finite segment of a shell of infinite extent (elastic core), and (2) uniform heating of a shell of infinite extent (viscoelastic core) supporting a ring load. Author

N66-34665*# General Technology Corp., Elgin, Ill.
LINEAR THEORY OF MICROPOLAR VISCOELASTICITY Technical Report No. 8-2
A. Cemal Eringen Jun. 1966 35 p refs
(Contract NASw-1299)
(NASA-CR-77219) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The present paper is concerned with the construction of a linear theory of viscoelasticity for micropolar solids. The constitutive equations of strain and micro-rotation rate dependent materials, stress and couple stress rate dependent materials, and continuous memory dependent micropolar elastic solids and fluids are obtained and the thermodynamic restrictions are studied. An indeterminate couple stress theory is also derived as a special case. Author

N66-34686*# Collins Radio Co., Cedar Rapids, Iowa. Environmental Analysis Group.
OPTIMIZATION OF VIBRATION TESTING TIME Technical Summary Report, 29 Jun. 1964–10 Oct. 1965
I. F. Gerks 15 Jun. 1966 159 p refs
(Contract NAS8-11276)
(NASA-CR-77338) CFSTI: HC $5.00/MF $1.00 CSCL 20K

A system of equations was developed to scale the vibration levels occurring in a structure subjected to field vibration so that a laboratory test consisting of sine dwell, sine sweep, random vibration, or any sequential combination of these, will cause equivalent fatigue damage in a similar structure. A Miles type analysis was made using the Palmgren–Miner and Corten–Dolan fatigue damage hypotheses. The resulting equivalence equations are based on the specimen's dynamic characteristics, natural frequency and transmissibility with the negative reciprocal of the slope of the damage accumulation curve appearing as the only fatigue characteristic in the equations. A computer program using the Palmgren–Miner version of the equivalence equations was developed. The equations were indirectly validated by vibrating sets of test specimens to the different types of input and comparing the predicted damage to the actual damage. The test specimens were externally damped 6061T-6 aluminum alloy cantilever beams. Four basic investigations were made, one of which was invalidated due to faulty instrumentation. The Palmgren–Miner fatigue hypothesis was found more accurate than the Corten–Dolan hypothesis in the prediction of damage for the three valid tests. Author

N66-34668*# General Technology Corp., Torrance, Calif.
REFLECTION OF PLANE WAVES FROM THE FLAT BOUNDARY OF A MICROPOLAR ELASTIC HALFSPACE
V. R. Parfitt and A. C. Eringen Jul. 1966 65 p refs */ts* Tech. Rept.-8-3
(Contract NASw-1299)
(NASA-CR-77233) CFSTI: HC $3.00/MF $0.75 CSCL 20K

The effect of microstructure in the solution of several problems of wave propagation is investigated. The propagation of plane waves in a micropolar elastic half-space and their reflections from a stress free flat surface are studied. It has been found that in a micropolar elastic solid six waves can exist traveling at four distinct speeds, three of which disappear below a critical frequency dependent upon the character of the medium. Reflection laws and amplitude ratios are presented for three specific problems. Author

N66-34681*# General American Transportation Corp., Niles, Ill. Research Div.
SHOCK AND VIBRATION. TRANSPORTATION ENVIRONMENTAL CRITERIA Final Report
Fred E. Ostrem and M. L. Rumerman 21 Sep. 1965 103 p refs
(Contract NAS8-11451)
(NASA-CR-77220; MR-1262) CFSTI: HC $4.00/MF $0.75 CSCL 20K

A comprehensive literature search was conducted for information and data describing shock and vibration environments in the four major modes of transportation (rail, truck, air, and water). Data specifically concerned with the transportation of rockets and allied equipment was sought. Based upon the data collected, acceleration versus frequency diagrams were constructed which describe the inputs to the transported package for each transportation mode. A number of acceleration versus frequency diagrams within the four major mode classifications were also constructed. These curves show the effects of various operating parameters on the transportation environment. Shock spectra are presented to describe the railroad coupling environment. Spectra are given for various impact speeds for both standard and high capacity draft gears. A curve showing the variation of railroad car speeds during coupling operations is also presented. The problems which arise in the interpretation of the various forms of data are discussed together with the applicability of the data to package design. Author

N66-34818# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
TRANSIENT NON-AXISYMMETRIC WAVE PROPAGATION IN AN INFINITE ELASTIC PLATE
Richard A. Scott and J. Miklowitz Jun. 1966 40 p refs
(Contract Nonr-220(57))
(TR-3; AD-635019) CFSTI: HC $2.00/MF $0.50

The solutions to a general class of transient nonaxisymmetric wave problems involving an infinite elastic plate are presented. The equations of motion from linear elasticity theory are employed and the solutions are obtained through the use of superposition and multi-integral transform techniques. The method of stationary phase is applied to obtain the predominant far-field disturbance for two particular problems, namely the sudden application of symmetric point shear and normal half-ring loads, and a numerical study is given in the former case. Author (TAB)

N66-34870# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.

TECHNIQUES FOR TESTING STRUCTURES PERMITTED TO SWAY Summary Report, 1964–1965

Erol Yarimci, Joseph A. Yura, and Le-Wu Lu May 1966 52 p refs

(Contract NObs-94092)

(Rept.-273.40; AD-634852) CFSTI: HC $2.00/MF $0.50

Mechanisms are described that eliminate the restraining effects of the loads and the lateral bracing on test specimens permitted to sway. One mechanism, called the gravity load simulator, maintains a vertical orientation of load even as a structure sways. The lateral bracing mechanism presented does not restrain a test structure at large deflections yet does not require any adjustments when the test specimen deflects. A gravity load simulator and a lateral bracing system designed for use in testing fullsize building frames are presented. Tests on the equipment itself and tests of building frames utilizing the mechanisms show very satisfactory behavior of the gravity load simulator and the lateral bracing system. Some actual test setups using the mechanisms are described. Tests on three-story full-size building frames (30 ft. high) and a frame buckling test are included. The hydraulic loading system and an electrical gage for measuring rotations that were developed for tests on full-size structures are also presented. Author (TAB)

N66-34880# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PLASTIC FLEXURE IN A FREELY-SUPPORTED CIRCULAR PLATE UNDER THE ACTION OF AN AXISYMMETRICAL LOAD

Zhu-Hua Xiun 20 Jan. 1966 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Teckhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 6, 1963 p 159–163

(FTD-TT-65-1477; TT-66-61422; AD-633820) CFSTI: HC $1.00/MF $0.50

The problem of rigid plastic flexure of a circular plate with a supported edge is considered. It is assumed that the material of the plate possesses linear hardening and satisfies the conditions of Tresk yield. A deformation law which is a special case of the hardening law for three dimentional stressed states is used. Equations are developed for plastic deformation of a plate partially loaded with a uniformly distributed load. N.E.N.

N66-34910# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTEGRO-DIFFERENTIAL EQUATIONS OF A PROBLEM FOR EQUILIBRIUM OF SHELLS OF ROTATION OF VARIABLE THICKNESS

G. I. Tkachuk 21 Jan. 1966 13 p refs Transl. into ENGLISH from Prikl. Mekhan. (USSR), v. 7, no. 3, 1961 p 266–271

(FTD-TT-65-1378; AD-634840) CFSTI: HC $1.00/MF $0.50

N. A. Kilchevsky's method is employed to deduce a system of integro-differential equations for the equilibrium of shells of rotation of variable thickness with an arbitrary load and arbitrary boundary conditions. A 'chart' of mean surfaces is constructed for the shells. The kernels of systems of integro-differential equations and the components of the auxiliary concentrated forces are calculated. The author notes that the solution of concrete problems may be obtained by digital methods with the aid of quick-response computers. Author (TAB)

N66-34950# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

THERMAL BUCKLING OF CONICAL SHELLS HEATED ALONG A GENERATOR

Dror Bendavid and Josef Singer Feb. 1966 48 p refs

(Contract AF 49(638)-1276)

(SUDAAR-258; AFOSR-66-0649; AD-635045) CFSTI: HC $2.00/MF $0.50

Thermal buckling of conical shells heated along a generator of the cone is analyzed by Rayleigh–Ritz approach in conjunction with displacement functions modified by a shape factor. A two-term solution is presented in detail and numerical results are correlated with a typical experiment. Author (TAB)

N66-34956# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanisms.

CREEP OF VARIABLE THICKNESS CIRCULAR PLATES

B. Venkatraman, Coleman Raphael, and Sharad A. Patel Jun. 1966 51 p refs

(Contract AF 49(638)-1360)

(PIBAL-921; AFOSR-66-0871; AD-634987) CFSTI: HC $2.00/MF $0.50

The report is concerned with the creep behavior of rotationally symmetric circular plates of varying thickness. The investigations are essentially based upon two types of analogies. In the first case, the analogy between the equations that govern the creep of a structure and those that govern the nonlinear elastic behavior of the same structure is used. In the other case, the similarity between creep flow and the flow rules of plasticity theory is utilized. Within the framework of these analogies, two exact methods of solution are initially presented. While the first is based upon a creep flow law associated with the Mises criterion of plasticity theory, the second uses the Tresca criterion of the same theory to formulate moment-curvature relations. These laws are then used as bases to obtain moment and deflection solutions for the case of a simply-supported plate under uniform pressure. Next, with a view towards developing approximate methods of solution for the analysis of more complex problems, Reissner's variational theorem is used to obtain solutions to the preceding problem. These are found to be in good agreement with the exact results. The approximate technique is then used to obtain solutions in the case of a plate with clamped edges. The results in all cases are presented in tabular, as well as graphical forms. These are found to be in good agreement with the exact results. The approximate technique is then used to obtain solutions in the case of a plate with clamped edges. Author (TAB)

N66-34970# David Taylor Model Basin, Washington, D. C. Structural Mechanics Lab.

TESTS OF FABRICATED MULTILAYERED RING-STIFFENED CYLINDRICAL MODELS UNDER EXTERNAL HYDROSTATIC PRESSURE Final Report

Richard V. Raetz Apr. 1966 31 p refs

(DTMB-2173; AD-635141) CFSTI: HC $3.00/MF $0.50

An exploratory investigation was carried out to study the strength of ring-stiffened multilayered cylindrical shells under external hydrostatic pressure. Four HY-100 steel models, having relatively large shell thickness-to-diameter ratios, were tested to collapse. The height-to-displacement ratios for all models were approximately equal. The tests indicated that for the height-to-displacement ratio studied, the strength of a single-layered ring-stiffened cylindrical model could be attained by a model with a shell consisting of two layers, each layer one-half the single-layered shell thickness, with a moderate increase in shell yield strength. It was also indicated that the strength of the single-layered model could not be attained in a model with a shell consisting of layers of one-fourth the single-layered shell thickness without a very large increase in the yield strength of both shell and frame material. Author (TAB)

N66-34971# ARO, Inc., Arnold Air Force Station, Tenn.
VACUUM DEPLOYMENT TESTS ON AN EXPANDABLE CREW TRANSFER TUNNEL Technical Report, Dec. 14, 1965–Jan. 6, 1966
N. C. Latture Arnold Eng. Develop. Center, Jul. 1966 25 p ref (Contract AF 40(600)-1200)
(AEDC-TR-66-66; AD-635196) CFSTI: HC $6.00/MF $0.50

An inflatable crew transfer tunnel, packaged in a canister, was tested in a simulated environment of 10^{-5} torr. The canister separation, tunnel deployment, and pressurization were successfully accomplished. A tunnel leakage rate was established over a 24-hr period with the tunnel pressurized to 0.5 atm while in the simulated environment of 10^{-5} torr.
Author (TAB)

N66-34995*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC FLUTTER INVESTIGATION OF MODELS OF A PROPOSED VARIABLE-SWEEP WING
Charles L. Ruhlin and John R. Gurley, Jr. Washington, NASA, Dec. 1962 44 p refs
(NASA-TM-X-739) CFSTI: HC $2.00/MF $0.50 CSCL 20K (Declassified)

The models were dynamically and elastically scaled from a wing design which had an aspect ratio of 7 (at minimum sweep), a taper ratio of 0.2, a fixed root section having a 65° sweepback angle, and a movable outboard panel. The elastic restraint at the pivot was simulated on the models. Models of the proposed wing and models of aspect ratio 5 were investigated at Mach numbers from about 0.7 to 1.25 with the outboard wing panel at leading-edge sweepback angles of 20°, 45°, 65°, and 80°. Author

N66-35006# Minnesota Univ., Minneapolis. Dept. of Aeronautics and Engineering Mechanics.
FOURIER-TRANSFORM TECHNIQUE FOR MEASURING TERMINATING IMPEDANCES
R. Plunkett and L.E. Wittig [1964] 25 p refs
(Contract NObs-92285)
(TR-66-4; AD-634745)CFSTI: HC $2.00/MF $0.50

The mechanical impedance of a foundation depends, in part, on the characteristics of the column attached to it. For this reason it is important to have a technique to find that mechanical impedance with the column in place; this requirement rules out direct measurement with an impedance head. This study was made to determine the usefulness of a transient loading technique for measuring the mechanical impedance of a complex termination. The method determines the impedance at the end of an elastic bar from the Fourier transforms of pulse shapes in the bar. Experimental results for a simple termination show that this technique can be used to measure the impedance of a lumped parameter system. However, comparison between transient loading measurements and direct measurements with an impedance head for a more complex termination show that not enough frequency information can be obtained to determine its impedance accurately enough. Author (TAB)

N66-35008# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
ANALYSIS OF UP-TO-FOUR-MASS SYSTEMS SUBJECTED TO GATE-FUNCTIONAL SHOCK AND IMPACT FORCES OF ARBITRARY DURATION WITH VISCOUS DAMPING
Hans H. Seidel Apr. 1966 101 p refs
(TN-R-201)

The motion of a four-degree-of-freedom system, consisting of four masses connected to one another by three linear springs and three linear viscous dampers, is described. The second order differential equations were solved by the Laplace transform method and the inversed response transforms were coded into a FORTRAN IV Univac 1107 computer program, which can treat systems with up to four masses with and without viscous damping. An example of a space vehicle system during docking and rendezvous maneuvers is presented. Author

N66-35018*# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.
LONGITUDINAL VIBRATION OF RING STIFFENED CYLINDRICAL SHELLS CONTAINING LIQUIDS Technical Report No. 7
Daniel D. Kana and H. Norman Abramson 15 Jun. 1966 39 p refs
(Contract NAS8-11045; SwRI Proj. 02-1391)
(NASA-CR-77396) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Axisymmetric responses of longitudinally excited ring stiffened cylinders were studied experimentally in the laboratory and compared with the predictions of the Bleich theory for the case of tanks having rigid flat bottoms. Tanks with flexible bottoms of both flat and elliptical geometry were also studied experimentally. Further, the effects of supporting the entire system on a flexible spring mount were investigated. It was found for such cases that the natural modes become infinite in number, and the lowest mode can be considerably different from that obtained when the liquid is considered to be a rigid mass. In general, it was found that the predictions of the Bleich theory compared well with the experiments for those cases in which it was applicable. Author

N66-35058# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
SOME STATISTICAL ASPECTS OF THE DETERMINATION OF A SAFE LIFE FROM FATIGUE DATA
Sam C. Saunders Apr. 1966 26 p refs *Its* Mathematical Note No. 455
(DI-82-0515; AD-634980) CFSTI: HC $1.00/MF $0.50

The probability that within a future large second sample no failures will occur before the expiration of a safe service life estimated from a small first sample and the probability that the proportion of all future observations failing before the estimated safe service life is smaller than a given proportion, are the two measures of safety that we adopt here. Assuming the logarithm of the fatigue life is normal with known variance, we derive formulae for these measures of safety. Setting the safe life as some fraction of the mean estimated by the first sample, we then compare the influence of other parameters on these measures of safety. From this assumption it is shown that one has virtually as high an assurance of safety, measured by the first criterion. When using only the minimum of the first sample, as one does by using all the observations in the first sample, if one uses the standard second criterion, namely, the confidence level of a lower tolerance bound as a measure, such an advantage is not retained. Author (TAB)

N66-35066# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
THE EFFECT OF PLASTIC DEFORMATION ON THE STRAIN ENERGY RELEASE RATE IN A CENTRALLY NOTCHED PLATE SUBJECTED TO UNIAXIAL TENSION Final Report, Dec. 1964–Jul. 1965
Royce G. Forman Jan. 1966 34 p refs
(AFFDL-TR-65-186; AD-632454) CFSTI: HC $2.00/MF $0.50

By using the Dugdale model for a crack in a plate, an improved formula was derived for the strain energy release rate, G. The formula has the same form as the solution for a linear elastic plate, except a correction factor is used which corrects for both the effect of yielding and the finite width of the plate. Curves are presented giving the values of the correction factor, and they indicate that the nominal stress to yield stress ratio has a pronounced effect on the strain energy release rate. Author (TAB)

N66-35092# Liege Univ. (Belgium). Laboratoire d'Aeronautique.

BENDING AND STRETCHING OF PLATES. SPECIAL MODELS FOR UPPER AND LOWER BOUNDS

B. Fraeijs de Veubeke 28 Oct. 1965 33 p refs Presented at the Conf. on Matrix Methods in Structural Mech., Dayton, Ohio, 26–28 Oct. 1965

(Contract AF 61(052)-892)

(SA-4; AD-632930) CFSTI: HC $2.00/MF $0.50

The purpose of this report is to deal with certain difficulties arising in the construction of equilibrium models of finite elements, yielding upper bounds or lower bounds to static influence coefficients. The constraints imposed on the number of parameters of the displacement field or the stress field, in relation to the number of generalized coordinates, in order to achieve either continuity of displacements or continuity of stress transmission within the structure, are sometime hard to satisfy. Two cases are presented; a displacement model for bending, and an equilibrium model for stretching, where the difficulties are removed by a particular grouping of elements in a larger building block. To make the report self-contained, the dual theories of displacement and equilibrium models are briefly reviewed. Author

N66-35111# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.

BUCKLING AND POSTBUCKLING OF AN AXIALLY COMPRESSED OVAL CYLINDRICAL SHELL

Joseph Kempner and Youl-Nan Chen Apr. 1966 62 p refs Presented at the 70th Anniv. Symp. on Shells, Houston Univ., 4–6 Apr. 1966

(Contract AF 49(638)-1360)

(PIBAL-917; AFOSR-66-0870; AD-63548) CFSTI: HC $3.00/MF $0.75

Energy expressions and related differential equations for non-circular cylindrical shells, analogous to the corresponding relations presented by Donnell for thin-walled circular cylindrical shells, are summarized. Appropriate energy expressions are then applied to the classical buckling and to the nonlinear postbuckling problems of an axially compressed oval cylinder whose cross section lying between 1 (the circular cylinder) and 2.06, that the out-of-roundness has a marked effect on the critical load, and that introduction of the maximum radius of curvature into the formula for the classical buckling stress of a circular cylinder leads to good results for thin-walled shells of moderate eccentricity of the cross section. The postbuckling behavior is investigated through the application of the principle of stationary potential energy together with an approximate deflection function. The latter represents a modification of the expression applied earlier by the authors. The new results show that, in addition to the previously observed relative minimum postbuckling load, a relative maximum postbuckling load, a relative maximum postbuckling load can exist. Furthermore, for controlled end-displacement loading, the large-deflection load vs end-shortening curve can correspond to stable equilibrium configurations throughout the entire loading range, whereas for dead-weight loading the region of the curve between the maximum and the minimum loads represents unstable configurations.

Author (TAB)

N66-35128 Stanford Univ., Calif.

CUT-OUTS IN MEMBRANE SHELLS

Ravindra Kantilal Vyas (Ph.D. Thesis) Mar. 1966 162 p refs

An iterative method in conjunction with conformal mapping was utilized to extend the membrane theory to the problem of a paraboloid shell of revolution with a square cut-out in its center. Openings in the form of polygons of greater complexity were also analyzed by the construction of suitable transformations that map these into known circles; conformal mapping was dispensed with in problems of circular openings in paraboloids of revolution, and elliptical openings in elliptical paraboloids which reduce to circular openings under an affine transformation. G.G.

N66-35130# Aerodynamische Versuchsanstalt, Gottingen (West Germany). Abteilung Aeroelastizitaet.

VIBRATION OF CANTILEVER ISOTROPIC TRAPEZOIDAL PLATES OF ARBITRARY PLANFORM BY THE RITZ-METHOD [BERECHNUNG DER EIGENSCHWINGUNGSFORMEN EINSEITIG EINGESPANNTER ISOTROPER TRAPEZ-PLATTEN BELIEBIGEN UMRISSES NACH DEM RITZ-VERFAHREN]

H. Foersching Jan. 1966 96 p refs In GERMAN; ENGLISH summary

(DLR-FB-66-11; AVA-FB-66-03) CFSTI: HC $3.00/MF $0.75

By use of the Ritz-method and with orthogonal polynomials as Ritz-functions the vibrations of cantilever isotropic trapezoidal plates are calculated. The calculations in the presented form are applicable to trapezoidal plates of any planform and are yielding at least the five lowest eigenvalues with sufficient accuracy. For 26 different planforms numerical results of the six lowest vibrations are given and compared with corresponding theoretical and experimental results already known. Author

N66-35133# Louvain Univ. (Belgium).

STABILITY AND RESISTANCE TO THE WIND OF CONSTRUCTIONS OBTAINED BY LARGE SHELL AND LATTICE DEFORMATIONS [STABILITE ET RESISTANCE AU VENT DE CONSTRUCTIONS OBTENUES PAR GRANDES DEFORMATIONS COQUES ET TREILLIS]

M. Van Laethem (Ph.D. Thesis—Paris Univ.) Paris, Assoc. Franc. de Rech. et d'Essais sur les Materiaux et les Construct. Feb. 1964 133 p refs In FRENCH

(Rept.-20) CFSTI: HC $4.00/MF $1.00

Static and dynamic loads are discussed in relation to the stability and resistance of wind of various structures. Principles, formulas, and models are considered for elastic surface planes and cylinders obtained by elastic flexure of isotropic plates; and the applicable stability equations are given. Study is also made of cylinders subjected to elastic preflexion by orthotropic lattice surfaces. Elastic deformation in rods is discussed, as is the calculation of cylindrical lattices. In the case of aerodynamic loading, discussions are included of the requirements of cylindrical coverings deformed by wind effects, the main cause for the destruction of light structures, and wind characteristics which affect various structures.

Transl. by M.W.R.

N66-35144# Royal Aircraft Establishment, Farnborough, (England).

RESONANCE TESTS ON A MOTOR CAR BODY

D. R. Gaukroger and F. J. Hawkins Jan. 1966 48 p refs

(RAE-TR-66022) CFSTI: HC $2.00/MF $0.50

Resonance tests on the body of a small two-door motor car have been made. Multipoint excitation has been used to excite the first five modes of vibration. It is shown that multipoint excitation has advantages over single point methods, and that the increased accuracy that it affords may be of use in locating regions of high stress. Author

N66-35170*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.

RESPONSE OF PANELS TO OSCILLATING SHOCK WAVES

M. J. Crocker Mar. 1966 59 p refs

(Contract NAS8-20073-1)

(NASA-CR-77435; WR-66-17) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Experimental data of oscillating shock waves experienced by space vehicles are examined to determine whether shocks oscillate in a random or discrete manner. Since there is evidence to suggest that shocks can oscillate at discrete frequencies, this was chosen as the principal theoretical model. Theory is formulated for the response of a simply-supported panel to sinusoidally oscillating shocks and to shocks moving at constant speed. Some analysis of the theory is made and it is found that first mode dynamic amplification factors as high as fifty could be experienced by a panel for a shock oscillating about the panel center, over the full span and at the panel resonant frequency, for typical panel damping.
Author

N66-35225*# North American Aviation, Inc., Los Angeles, Calif.
STRUCTURAL ANALYSIS, DESIGN, AND DEVELOPMENT OF AN S-IC SKIN PANEL, 1 JULY–10 DECEMBER 1965
P. A. Boukidis 10 Dec. 1965 97 p refs
(Contract NAS8-20530)
(NASA-CR-77526; NA-65-1004) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Phase I, the development phase, was concluded with the successful fabrication of four 9×38-inch developmental panels and the testing of elemental specimens for bond strength. A typical panel selection involved the roll diffusion bonding of discrete titanium strips (8Al-1Mo-1V) to produce integral-type Tee-section stiffeners on flat sheet panel specimens. The technical feasibility and structural integrity of the roll diffusion bonding process as it relates to the fabrication of highly-efficient integrally stiffened skin panel sections as production items was demonstrated. The technical successes achieved to data justified the sizing and selection of the configuration for the full-scale production panels (9.75 by 28 feet).
Author

N66-35312*# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.
A RIGOROUS DERIVATION OF SECOND-APPROXIMATION THEORY OF ELASTIC SHELLS Technical Report No. 5
William C. L. Hu 10 Nov. 1965 47 p refs Submitted for Publication
(Contract NASr-94(06))
(NASA-CR-66055) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A rigorous derivation and new analytical viewpoint of linear shell theory are presented which aim at resolving some fundamental difficulties in elastic shell theory. The approach is based on the concept that the stress and displacement components in three-dimensional elasticity can be expanded into infinite series of the Legendre polynomials of a dimensionless thickness variable, which converge uniformly and rapidly in the thickness interval. The shell equations are derived through integration of the linear elasticity equations. The orthogonality property of the Legendre polynomials uncouples most higher order terms during the integration process. A minimum number of assumptions are then introduced after the integration and only when necessary. The *a priori* Kirchhoff–Love hypothesis is replaced by a more rigorous accuracy criteria.
Author

N66-35313*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FATIGUE LIFE UNDER VARIOUS RANDOM LOADING SPECTRA
Sherman A. Clevenson and Roy Steiner [1965] 28 p refs Presented at the 36th Symp. on Shock and Vibration, New Orleans, 25–28 Oct. 1965
(NASA-TM-X-56984) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A study of the fatigue life of aluminum-alloy specimens under various random loading spectra has been conducted. It was indicated that for the three spectra considered, $\phi(\omega)=K_1\omega^{-2}$, $K_2\omega^{0}$, and $K_3\omega^{+2}$, there was essentially no difference in fatigue life. The effect of the ratio of peaks to zero-mean crossings was found to be negligible in the range of ratios investigated. The results of the investigation indicated that the linear cumulative damage theory was very unconservative especially at the low stress levels. Fractograph studies showed qualitatively the expected types of failure wherein the outer sections of the specimen failed due to fatigue and the inner area failed due to tensile loading.
Author

N66-35337# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELASTIC EXPANSION-WAVE PROPAGATION FROM A CIRCULAR HOLE IN A CYLINDRICALLY ANISOTROPIC INHOMOGENEOUS PLATE
Y. D. Kubenko [1965] 12 p refs Transl. into ENGLISH from Kontsentratsiia Napriazh. (Kiev), no. 1, 1965 p 164–173

Stress propagation in a thin infinite plate is investigated for the case when a pressure, which later remains constant, is suddenly applied to the contour of a circular hole. The plate material is assumed to be cylindrically anisotropic (the anisotropy axis agrees with the z axis of a cylindrical coordinate system), and continuously inhomogeneous so that the Young's moduli are functions of the radial coordinate.
Author

N66-35343# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A CASE OF DYNAMIC STRESSES IN AN UNBOUNDED ELASTIC SPACE WITH A CYLINDRICAL CAVITY
M. M. Sidliar [1965] 9 p refs Transl. into ENGLISH from Stress Concentrations (Kiev), no. 1, 1965 p 233–238

A solution is proposed to the dynamic problem of stresses in an unbounded space with a circular cylindrical cavity of radius, resulting from the effect of harmonically time-varying power sources distributed uniformly in two planes parallel to the cylinder axis. Emphasis is placed on an analysis of the stressed state around the cavity. Equations are formulated for the fundamental stress field, perturbation stresses, surface cavity stresses, and the long wave case.
M.G.J.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-34143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF HEAT FLOW IN THE ENVIRONMENT OF A CRITICAL POINT OF DOUBLE CURVATURE DURING THE FLOWING AROUND OF A BODY BY A DISSOCIATING GAS OF ARBITRARY CHEMICAL COMPOSITION
G. A. Tirskiy *In its* J. of Appl. Mech. and Tech. Phys. 31 Jan. 1966 p 1–22 refs (See N66-34142 20-12) CFSTI: HC $2.00/MF $0.50

Consideration is given to the laminar boundary layer of compressible ideal gas flowing around a body in an environment of a critical point of double curvature. The results of numerical solutions are approximated for heat flow as a formula dependent on the change of product of viscosity and density across the boundary layer, and on the ratio of the main radii of curvature. The use of effective coefficients of diffusion in a multicomponent boundary layer, and the generalized analogy between heat and mass transfer are used to derive formulas for heat

flow of a gas of arbitrary chemical composition. The calculations are carried out under the assumption that all reactions of recombination proceed on the wall. C.T.C

N66-34167# Institute for Defense Analyses, Arlington, Va. Economic and Political Studies Div.

THERMAL EFFECTS OF NUCLEAR WEAPONS Literature Summaries

Abner Sachs and Dorothy Harris Jan. 1966 328 p refs (Contract OCD-OS-63-134)

(IDA-HQ-66/4480; P-221; AD-634204) CFSTI: HC $7.00/MF $1.50

Contents: ignition of materials; ignition points; atmospheric effects; thermal effects of nuclear detonation, fire susceptibility factors; thermal damage assessment models; fire development; mass fires, firespread models; countermeasures; fire protection. TAB

N66-34208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF BAFFLE EFFECTIVENESS IN A CONFINED FLUID SUBJECTED TO WALL AND NONUNIFORM SOURCE HEATING

Thomas John Biesiadny (M.S. Thesis—Purdue Univ.) Aug. 1966 66 p refs

(NASA-TM-X-52236) CFSTI: HC $2.50/MF $0.75 CSCL 20M

Heating of liquid hydrogen in the propellant tank of a nuclear rocket was simulated in a two dimensional view tank with and without baffles present. A mixture of trichoroethane and ethyl alcohol was used to represent the liquid hydrogen. Infrared rays from quartz lamps were used to produce the two types of heating required. The tanks were subjected to similar heating conditions with and without baffles, and visual information concerning fluid behavior was obtained using schlieren photographs. Fluid temperatures were measured using thermocouples. Baffles were found to be quite effective during the early portion of each transient run and throughout most of the transient period for each run carried out with a low wall heating rate. With a sizeable rate of nonuniform source heating present, the effectiveness of the baffles was decreased as compared with their effectiveness under similar conditions but in the absence of source heating. Author

N66-34217# Princeton Univ., N. J. Guggenheim Labs. for the Aerospace Propulsion Sciences.

RESEARCH ON SOLID PROPELLANT IGNITION Annual Technical Progress Report, 1 Oct. 1964–30 Sep. 1965

C. H. Waldman and Lubomyr Kurylko Mar. 1966 77 p *Its* Aerospace and Mech. Sci. Rept.-770

(Contract AF 49(638)-1267)

(AFOSR-66-0939; AD-634276) CFSTI: HC $3.00/MF $0.75

The mechanism of ignition being analyzed is based on the hypothesis that the runaway reaction occurs in the gas phase, in a thin boundary layer adjacent to the solid propellant surface being heated, between the reactive fuel and oxidant vapors liberated from the surface. Differential equations can be written for the diffusion of vapors from the surface, reaction in the gas phase, heat feedback to the surface, and heating up of the surface. As a first treatment the propellant is taken as a simple fuel and the oxidant is available only in the gas phase. An experimental study was conducted to determine the ignition delay time for various hydrocarbons and for solid propellants when exposed suddenly to a hot, high pressure oxidizing atmosphere. The main purpose was to measure effects that would help in a diagnostic way to decide whether the gas phase theory of ignition is based on the correct physical model. Attempts were made to relate the ignition delay to physical and chemical properties of the fuel to test the hypothesis that the ignition reaction of these compounds starts in the gas phase. A 19 foot long, 1.6 inch I.D. shock tube was used as an investigating tool. The test gas was heated to 1400° K behind the reflected shock wave at the end wall of the shock tube. Author (TAB)

N66-34252# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

HEAT TRANSFER IN THE CASE OF TURBULENT MOTION OF A FLUID IN AN ANNULAR DUCT

V. P. Isachenko and N. M. Galin 19 May 1966 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Energ. (Minsk), no. 6, 1965 p 68–73

(Contract NOw-62-0604-c)

(TG-230-7480; TT-66-61475; AD-634232) CFSTI: HC $1.00/MF $0.50

The applicability of formulas for the calculation of heat transfer in circular ducts to non-circular ducts is discussed. The resultant deviation of the heat transfer coefficient, in some instances considerable, are probably due to the effect of the diameter ratio, which takes the variations of temperature and velocity fields in annular ducts into account. To clarify this problem, the average heat transfer in a smooth straight annular duct was investigated for a water flow with water as the secondary heat transfer medium. The results showed that the accuracy of calculations can be improved considerably by applying a correction factor.

Author (TAB)

N66-34287# Pennsylvania Univ., University Park. Ordnance Research Lab.

TRANSIENT DROPLET GROWTH DURING DROPWISE CONDENSATION

Charles J. Hurst (Thesis) 27 Apr. 1966 158 p refs

(Contract NOw-65-0123-d)

(AD-633702) CFSTI: HC $5.00/MF $1.00

The study investigated the possibility of determining high heat-transfer rates during dropwise condensation by analyzing single condensate droplets growing on a convectively-cooled surface. A mathematical model included both the droplet and a portion of the condensing surface. Experiment utilized condensate droplets, growing on a thin copper surface, to verify the analysis. Experimental results agreed closely with predicted results–indicating high heat-transfer rates at droplet perimeters. Both experiment and analysis showed that no single vapor-to-condensing-surface temperature difference may be expected during dropwise condensation. Limitations on the calculation procedure pertaining to the region around the droplet perimeter restricted the accuracy of heat-transfer rate predictions; a separate study of droplet perimeter is suggested. Author (TAB)

N66-34302# Office of Naval Intelligence, Washington, D. C. Translations Section.

THE MECHANISM OF ACTION OF EXPLOSION AND PROPERTIES OF EXPLOSIVES [O MEHANIZME DEYSTVIYA VZRYUA E SVOYSTVAH VZRYVCHATYH VESHCHESTV]

G. P. Demiduk [1966] 28 p refs Transl. into ENGLISH from Vzryvnoye Delo (Moscow), symp. no. 45/2

(ONI-TRANS-1063; AD-633490) CFSTI: HC $2.60/MF $0.50

This investigation was performed because previous tests established that Igdanites yield better rock fracture than Ammonites, although Ammonite has a greater explosive power. Reviewed and compared are the findings of other investigators, and pertinent standards and norms established by Soviet agencies are cited. Among the factors that were considered are disposition, shape, and construction of the explosive charges; sequence of explosion; fracturing index; soil properties; shattering form of a blast; shock wave effects; detonation energies; and explosive charge requirements. The investigation centers on rock formations and gives special consideration to coal and ore mining. Air cavities and bore hole disperaion are discussed as means of controlling the energies

of a blast. The mixing of explosives of varying granulation, and the effects of mixed solid–liquid explosives, are also evaluated. K.W.

N66-34373*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DIRECT CALCULATION OF SPECIFIC HEATS AND RELATED THERMODYNAMIC PROPERTIES OF ARBITRARY GAS MIXTURES WITH TABULATED RESULTS

Perry A. Newman and Dennis O. Allison Washington, NASA, Aug. 1966 57 p refs

(NASA-TN-D-3540) CFSTI: HC $2.50/MF $0.50 CSCL 20M

It is shown that the partial derivatives of the species concentrations can be computed using the same matrix of coefficients as that used in the free-energy minimization iterations to determine the equilibrium concentrations. The second-order thermodynamic properties directly computed from these derivatives agree very well with existing properties (both directly and numerically obtained) for air considered as a mixture of ideal gases. Comparison of these results with recent imperfect air results shows that the "mixture of ideal gases approximation" produces acceptable engineering data (error less than 5 percent) for temperatures $\leq$ 15,000° K and pressures $\leq 10^2$ atmospheres. Tabulated results for the high-temperature thermodynamic properties of NASA engineering model Mars atmosphere 3 are given for 36 pressures at each of 56 temperatures. Author

N66-34412# Douglas Aircraft Co., Inc., Santa Monica, Calif.

SOME THERMAL ASPECTS OF A CONTAINED FLUID IN A REDUCED-GRAVITY ENVIRONMENT

S. H. Schwartz and M. Adelberg *In* Lockheed Missiles and Space Co. Fluid Mech. and Heat Transfer under Low Gravity [1965] 47 p refs (See N66-34408-20-12) CFSTI: HC $7.70/MF $2.25

A survey of the various factors affecting heat transfer to a liquid in a container is made emphasizing their effect on pressure buildup prediction in cryogenic propellant tanks. The various heat-transfer modes are reviewed and examined in terms of the magnitudes of the acting forces. Critical values of force ratios are developed. The prediction of the conditions under which the inception of boiling will occur is considered. Utilizing laminar and turbulent flow analyses, the location on a vertical wall where the critical temperature is reached is defined as a function of the heat flux and gravity level. A more precise method is also presented. Summary plots indicating the heat-transfer domains are included. Since the transient time period for the sudden heating of a vertical wall is large in the low-heat-flux low-g regime, equations are presented to estimate the transient periods for non-boiling turbulent flow and for boiling flow. Also, other factors involved in the analysis of practical stratification problems are considered, including the critical wall angle where instability effects result and the point where conduction is of the same magnitude as convection. Existing computer programs for handling stratification are reviewed. Modifications for extending their usefulness are discussed. Author

N66-34430*# National Aeronautics and Space Administration, Washington, D. C.

HEAT TRANSFER COMPUTER PROGRAMS

[1964] 167 p refs Proc. of conf. held at NASA Headquarters, 7 May 1964

(NASA-TM-X-56166) CFSTI: HC $3.25/MF $1.00 CSCL 20M

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N66-34431*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MSFC COMPUTER PROGRAMS UTILIZED IN THE THERMAL DESIGN AND ANALYSIS OF SATELLITES

William C. Snoddy *In* NASA, Washington Heat Transfer Computer Programs [1964] 33 p refs (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

Three IBM 7094 computer programs are described which are used for integrating spectral reflectance or emittance data, and for calculating satellite surface temperatures and percent time spent in the earth's shadow during a revolution. The spectral program integrates radiometric data with respect to blackbody radiation at any temperature or with respect to the Johnson solar radiation curve. Prior to integration the program will compute either emittance, transmittance, or reflectance, given the other two parameters, by using Kirchoff's law. The shadow–sunlight program can calculate the orbital positions where the satellite enters and leaves the earth's shadow and the percent time spent in the shadow. Calculations are also made for successive days by extrapolation of the orbital elements considering perturbations caused by the oblateness of the earth. The basic equation used in the general space thermal program is a first order differential equation representing the instantaneous heat flow into and out of a section of the spacecraft, the temperature of which is assumed to be such that it can be represented by one effective temperature. Examples, charts, and graphs are given for each program. E.A.O.

N66-34432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THREE DIMENSION HEAT TRANSFER PROGRAM

Edward I. Powers *In* NASA. Washington Heat Transfer Computer Programs [1964] 10 p (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

An IBM 7094, three dimensional, heat transfer program for satellite application is discussed. The program may be applied to all phases of spacecraft life, from launch to orbital quasi-steady state. Internal heat exchange by conduction and radiation is determined, provided the appropriate conductances, radiation view factors, and effective emittances are known. A simplified analysis of an active thermal controlled spacecraft is incorporated into the program. One or more surfaces may contain shutter systems which have optical properties specified as a function of shutter opening. The program evaluates the feasibility of any configuration based upon maintaining an internal component within its tolerable temperature limits. Author

N66-34434*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATIONS OF THE METHOD OF MONTE CARLO TO PROBLEMS IN THERMAL RADIATION

John R. Howell *In* NASA. Washington Heat Transfer Computer Programs [1964] 12 p refs (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

A summary of the work involving the Monte Carlo method in the solution of problems in thermal radiation transfer is presented, which indicates general methods previously used for solving problems in which radiation is coupled with other modes of energy transfer. Previous work involving radiation in absorbing-emitting media is included. An example is outlined to indicate the use of the Monte Carlo method in the design of a space radiator. Suggestions are given for solution of a complex case incorporating the effects of coupled conduction, convection and radiation, wavelength dependent and selective surfaces, nonisothermal conditions, and strongly directional or nondiffuse emitting and reflecting surfaces. A discussion is given of the factors that may affect convergence, running time, and accuracy of the Monte Carlo solutions and of the advantages and disadvantages of this approach for practical problems. Also discussed are the case of programming for complex problems and the probably machine time requirements of the method. Author

N66-34435*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

ORBITING SATELLITE SURFACE TEMPERATURE PREDICTION AND ANALYSIS

Robert A. Vogt *In* NASA. Washington Heat Transfer Computer Programs [1964] 17 p (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

An IBM 7094 computer program in Fortran II was developed to determine spacecraft heat loads and/or thin skin transient temperatures while orbiting the moon, earth, or other planets. The program can consider up to 200 elements, each with its own thickness, initial temperatures and thermal properties. Coatings, substrate materials, vehicle orientation, internal heat, and constant or variable planetary temperatures are also covered. Simplifying assumptions for the program are outlined. Coordinate systems are described which define surface elements and the location of the vehicle. The vehicle coordinate system consists of replacing the complex configuration with a spherical mathematical model. The position of the vehicle is defined with respect to the planet orbited, the celestial sphere, and the sun. Two cases of a hypothetical lunar orbital mission are illustrated using variable and constant surface temperature parameters. Charts are given showing the various coordinate systems, and the results of the case studies. E.A.O.

N66-34436*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SIMPLIFIED COMPUTATION OF EARTH THERMAL AND ALBEDO RADIATION INCIDENT ON A SPACECRAFT

Doyle P. Swofford *In* NASA. Washington Heat Transfer Computer Programs [1964] 7 p (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

The integral used for the computation of the earth thermal and albedo flux on a section of a satellite is directly integrable if the projected area is represented by a truncated Fourier series in the aspect angle. A great saving in computer time results from this representation. The series for a general surface of revolution, whose axis coincides with the axis of rotational symmetry of the satellite, is obtained by dividing the surface into elemental conical frustums and averaging the series for a cone over the generating curve. Author

N66-34437*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MONTE CARLO TECHNIQUES FOR SOLVING TRANSPORT PROBLEMS

Morris Perlmutter *In* NASA. Washington Heat Transfer Computer Programs [1964] 9 p refs (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

A discussion of the Monte Carlo procedure which focuses on methods used in obtaining sample histories and mean properties, is presented. Rarefied gas flow through a channel is considered to illustrate methods used in obtaining sample histories. A similar problem for ionized gas flow through a channel with a magnetic field across the channel is also treated. Inherent problems associated with the use of this technique such as the large amount of computer time required to obtain solutions are cited, and speculation is made concerning the efficiency of this technique as compared to more standard procedures. S.C.W.

N66-34438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DISCUSSION OF THE GENERAL ELECTRIC PROPOSAL TO DEVELOP A COMPUTER PROGRAM TO SELECT THERMAL COATINGS FOR PASSIVE TEMPERATURE CONTROL OF SATELLITES

Robert E. Kidwell, Jr. *In* NASA. Washington Heat Transfer Computer Programs [1966] 12 p (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

Pros and cons of a proposal for the development of an IBM 7094 computer program which would select the exterior surface coatings for passively controlling spacecraft temperatures are discussed. Described are the procedures used to develop a coating selection program within specified restrictions, and generalized objectives of the overall proposed program. Two examples are cited to illustrate how the present program works. Considered are a simple spacecraft which can be represented by equations describing the heat transfer at two locations or nodes, and a cylinder in a polar orbit near the earth with the axis of the cylinder parallel to the velocity vector and with one side of the cylinder always facing the earth. Reservations concerning the proposed program focus on inherent problems associated with programming and the amount of machine time required to run such a program. The infinite patience of a computer and the amount of time that would be saved in the coating selection phase of the thermal design are cited as primary advantages of the proposed program. S.C.W.

N66-34439*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPACECRAFT HEAT TRANSFER ANALYSIS

J. A. Plamondon *In* NASA. Washington Heat Transfer Computer Programs [1964] 5 p (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

The position of computing as a tool for developing the thermal design of a spacecraft is discussed. The abilities and limitations of digital computers are outlined, and the difficulties encountered in computational modeling are considered to arise from two sources: the modeling of the heat flow paths present in the hardware and the assigning of numerical values to describe lumps and the interactions between lumps. Methods of better integrating the digital computer into the design effort are described. A heat transfer program, based on the method of zones for calculating temperature distribution, is also summarized. The program which was specifically designed for spacecraft heat transfer problems, is defined as an approach that consists of breaking a problem into zones of finite area for two-dimensional situations and into finite volumes for three-dimensional situations. It was pointed out that one of the most important advantages of the program is that the equations are written in terms of flux rather than of temperature permitting the utilization of Oppenheim's network method for diffuse interreflections or Bobco's corollary for specular interreflections involving planar surfaces. L.E.W.

N66-34440*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ORBITER HEAT FLUX COMPUTER PROGRAM

W. A. Hagemeyer *In* NASA. Washington Heat Transfer Computer Programs [1964] 5 p refs (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

A set of parametric curves of absorbed heat flux for specific geometries, and a generalized computer program whose output is absorbed heat flux on the surfaces of a planet orbiting spacecraft are being developed. The absorbed heat fluxes include the effects of blockage by and reflections from adjacent spacecraft surfaces, assuming all surfaces to be diffuse. The final computer program will calculate fluxes on any of ten arbitrarily positioned plane surfaces, with any surface properties, planetary radiation characteristics, solar intensity, and orbital parameters. Outputs will be heat fluxes versus time, geometrical configuration factors, and radiant flux interchange factors. Author

N66-34441*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

BASIC APPROACH IN JPL COMPUTER PROGRAMS

Frederick N. Magee *In* NASA. Washington Heat Transfer Computer Programs [1964] 4 p (See N66-34430 20-33) CFSTI: HC $3.25/MF $1.00

Criteria for the selection of a computer program for spacecraft heat transfer problems are outlined, and the characteristics of the program chosen are listed. Programs were evaluated on the basis of simplicity, highly systemized inputs formats, minimum interpretation of the data input by the key punch operator, double storage of the input data to permit external checking, and an output format which included a print-out of the input data. The program chosen combined simplicity and a capability for transient and steady-state solutions for the same input data. Input parameters are given along with some additional features. E.A.O.

N66-34518# Massachusetts Inst. of Tech., Cambridge. Cryogenic Engineering Lab.

THE INCEPTION OF NUCLEATE BOILING WITH LIQUID NITROGEN Final Scientific Report, Jan. 1965–Jan. 1966

David W. Almgren and Joseph L. Smith, Jr. Apr. 1966 88 p refs

(Contract AF 19(628)-4972)

(AFCRL-66-271; AD-634256) CFSTI: HC $3.00/MF $0.75

Delayed inception of nucleate boiling and patchwise boiling are discussed and the significant parameters restricting the growth of a boiling patch are analytically determined to be: (1) a high nucleate boiling heat transfer coefficient: (2) a low total heat flux; (3) the absence of cavities with a trapped liquid–vapor interface outside the boiling patch; (4) an appropriate value of wall thermal conductivity; (5) a high vapor enthalpy per bubble. A qualitative agreement between theory and experiment was observed for items 1, 2, 3 and 4. A series of pool-boiling tests were conducted at one atmosphere of pressure in order to develop a surface finish that would eliminate the observed temperature hystresis at inception of boiling of liquid nitrogen. The best surface finish developed used a bi-metallic (Zn+Cu) flame spray process. The flame spray and a 0.3-micron-grit polished copper surface were tested for their nucleation properties in forced flow of liquid nitrogen. Visual observations indicated that nucleation occurred promptly on both surfaces at approximately the same wall temperature. Author (TAB)

N66-34529# Office of Naval Intelligence, Washington, D. C. Translation Section.

ON THE TRANSITION OF BURNING OF EXPLOSIVES TO DETONATION [O PEREKHODE GORENIYA VZRYVCHATYKH VESHCHESTV VO VZRYN]

K. K. Andreyev [1966] 23 p refs Transl. into ENGLISH from Vzryvnoye Delo, Nauchno-Tekhn. Gornoe Obshchestvo, Sbornik (USSR), v. 9, no. 52, 1963 p 130–140

(ONI-TRANS-2143; AD-634307) CFSTI: HC $1.00/MF $0.50

Topics include: factors determining the possibility of the transition from burning to detonation, characteristics of self-acceleration of burning of powdered explosives, influence of particle size and powder density on the transition from burning to detonation, and transition of burning to detonation in liquid explosives. Author (TAB)

N66-34559# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REPORTS OF THE ACADEMY OF SCIENCES OF THE USSR Selected Articles

17 Feb. 1966 21 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 161, no. 5, 1965 p 1118–1120, 1152–1155

(FTD-TT-65-1002; AD-633681) CFSTI: HC $1.00/MF $0.50

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N66-34560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE MECHANISM OF HIGH TEMPERATURE METHANE OXIDATION IN SHOCK WAVES

V. V. Voyevodskiy and R. I. Soloukhin *In its* Rept. of the Acad. of Sci. of the USSR 17 Feb. 1966 p 1–9 refs (See N66-34559 20-33) CFSTI: HC $1.00/MF $0.50

The ignition delay and reaction energy behind reflected shock waves were investigated with pure methane and with a mixture diluted with argon and helium. A branching tube was used by which the flow behind the falling wave bypassed the

central section, thus eliminating reaction of the reflected shock wave with the boundary layers. The results coincided with those obtained in an ordinary shock tube. In a second series of experiments, schlieren photography and pressure recordings were performed simultaneously with photometric determinations of the natural illumination of the compressed mixture in the hydroxyl radiation zone. No changes in effective activation energy were noted. Experiments were conducted in the temperature range of 1250° to 2500° K and with an activation energy of 33 kcal/mol. The chemical reaction of the methane was analyzed. Results were found to agree with findings of other investigators. K.W.

N66-34561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETONATION OF NITROGLYCERIN WITH SMALL VELOCITIES

I. M. Voskoboynikov, A. V. Dubovik, and V. K. Bobolev *In its* Rept. of the Acad. of Sci. of the USSR 17 Feb. 1966 p 10–17 refs (See N66-34559 20-33) CFSTI: HC $1.00/MF $0.50

In investigating the initiation of a reaction in front of a low velocity detonation wave, the presence of a shock wave in front of the detonation is demonstrated by gluing a lead azide tablet on a metallic disk and placing it on the front of a cylindrical charge opposite the ignition point. A detonation illumination photoscanner illustrated that the tablet explodes at the moment the impact wave charge arrives at the front of the shell. In a similar experiment with a lead azide tablet, the stability of detonation regimes with velocities of 800 to 1000 m/sec and 2000 m/sec for nitroglycerin was investigated. Shells with round, square, and triangular sections were used. For the case of the lower velocities it is concluded that the velocity of sound behind the shock wave is affected by the disintegration of the nitroglycerin; a weak detonation wave spreads behind the shock wave. In case of the 2000 m/sec velocity, a rarified wave follows the shock wave and penetrates the nitroglycerin layers, causing a discontinuum and developing peripheral regions; the reaction is more intense and the velocity is greater. K.W.

N66-34598# Princeton Univ., N. J.

KINETICS OF THE BRANCHING STEP IN THE REACTION OF HYDROGEN WITH OXYGEN

Shelby Clarke Kurzius (Ph.D. Thesis) Dec. 1964 146 p refs (Contract AF 49(638)-32)

(AFOSR-66-1311; AD-635159) CFSTI: HC $4.00/MF $1.00

Lower explosion limits in hydrogen-oxygen and deuterium-oxygen mixtures were measured in the diffusion-regime. From the data, the rate constants for the reaction H_2 to OH+O and its isotope effect were calculated between 800 and 1000° K. A theory is presented for reactions of essentially zero activation energy which, when applied to the above reaction and its reverse, leads to a rate constant expression which is a hybrid between that of the absolute rate theory and that of the classical collision theory of reactions. Subsidiary observations and theory related to the kinetics of the branching reaction and its elucidation by the method of explosion limits are reported. These include: the concept of chain branching efficiencies; contributions to the theory of explosion limits; observations and the explanation of very long induction times in the vicinity of the lower explosion limit in the diffusion regime; observations on the kinetics of the reaction H_2+M to HO_2+M and its isotope effect with deuterium; similar observations for the reaction O+H_2 to OH+H; and observations on the elusive subject of chain initiation, which indicate that the initiation process is heterogeneous at the low pressure of these experiments. Author (TAB)

N66-34708# Argonne National Lab., Ill.

PROPERTY VALUES OF PARA-HYDROGEN

Mark E. Stephenson Mar. 1965 167 p refs Supersedes ANL-6673; see N63-14076

(Contract W-31-109-ENG-38)

(ANL-7004; ANL-6673) CFSTI: HC $5.00/MF $1.00

Tables are presented of the properties of para hydrogen from 36 to 5400°R and from 14.7 to 2400 psia, as calculated by the H2P code of O.A. Farmer. The properties include enthalpy, entropy, specific volume, specific heat, viscosity, thermal conductivity, and Prandtl number. Graphs are also presented of the molecular weight, specific impulse in vacuum, vapor pressure, latent heat of vaporization, surface tension, parahydrogen percentage, and sonic velocity. Some comparisos of the results with previous data are given. NSA

N66-34710# Babcock and Wilcox Co., Lynchburg, Va. Atomic Energy Div.

NONUNIFORM HEAT GENERATION EXPERIMENTAL PROGRAM Quarterly Progress Report No. 11, Jan.–Mar. 1966

[1966] 83 p refs

(Contract AT(30-1)-3238)

(BAW-3238-12; EURAEC-1629) CFSTI: HC $3.00/MF $0.75

Complete sets of data were obtained on four tubular test sections. One set had uniform flux to serve as a reference condition, and three had nonuniform axial heat flux to show the effect of flux distribution on critical heat flux conditions. These data were compared with those of other investigators where comparable data were available. Empirical correlations were developed to express mathematically the effects of the various operating variables on critical heat flux. Before the present report period, complete sets of data were obtained on three annular test sections. In the first case, the inside surface was heated, in the second the outside surface was heated, and in the third both surfaces were heated. Comparison with published burnout correlations revealed a need for improved correlations. During this report period, data were obtained on an annular test section with nonuniform flux on the outside surface and zero flux on the inside surface. Additional data were obtained with nonuniform flux on the outside surface and uniform flux on the inside surface. Author (NSA)

N66-34713# Nuklearni Institut Josef Stefan, Ljubljana (Yugoslavia).

THE ASYMPTOTIC ANGULAR DEPENDENT LEAKAGE SPECTRUM OF THERMAL NEUTRONS

R. Kladnik Aug. 1964 19 p refs Submitted for Publication (NIJS-R-435)

The application of the variational method in velocity-dependent transport theory is described for the case of a pulsed infinite slab. The extrapolated endpoint and the buckling as functions of the slab thickness are calculated from a given transcendental equation. The expression for the angular and energy distribution of leakage neutrons is improved by one iteration of the integral transport equation. The results are discussed for three different scattering models: monatomic gas, Nelkin water, and the Egelstaff model. It is found that Nelkin's model gives a better estimate for the integral constants, whereas the Egelstaff's law is more suitable for the differential spectrum calculations. Author (NSA)

N66-34736# Brookhaven National Lab., Upton, N. Y. Information Div.

VALIDITY OF MEASUREMENT OF ELECTRON TEMPERATURE IN A FLAME BY MEANS OF LANGMUIR PROBES WITH A COLD WALL

Rahim Ahrabi and Siegfried Klein 30 Jul. 1965 6 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 258, 23 Mar. 1964 p 3228–3231

(BNL-TR-7)

The results of measuring the electron temperature in a flame (illuminating gas by air) by means of electrostatic probes with internal water circulation are presented. A comparison of results of electron temperature measurements taken by a hot electrode near a cold wall is made with results from the cold electrode. NSA

N66-34767# Lehigh Univ., Bethlehem, Pa. Inst. of Research.
MATHEMATICAL AND EXPERIMENTAL INVESTIGATION OF THERMAL INITIATION OF EXPLOSION Progress Report, 1 Jan.–31 Mar. 1966
Fred P. Stein 1 Apr. 1966 2 p
(Contract DA-28-017-AMC-1090(A))
(AD-634802) CFSTI: HC $1.00/MF $0.50

The lead azide reaction chamber was mounted inside the aluminum block, which is the core of the constant-temperature furnace, and tests were run to determine the constancy of temperature inside this furnace. The aluminum block is heated by 24 heaters which are grouped into three zones–two end zones and a central zone. Each zone of heaters has its individual variable transformer so that the power input to each zone may be individually adjusted. Each zone transformer is connected to the main transformer, which is controlled by the Bayley temperature controller. Tests have shown that, for periods up to a week in duration, temperature variations in the center of the the furnace could not be detected (measurements on a 5–15 mv strip-chart recorder). These furnace temperatures are, of course, merely the environment for the reaction chamber which will have its own heater and temperature controller for more precise control. Steps are being taken to isolate the motors and to modify the balance mounting to alleviate the vibrations. Author (TAB)

N66-34817# Astrosystems International, Inc., Fairfield, N. J.
COMBUSTION GAS EMITTED RADIATION AND CHEMILUMINESCENCE PHENOMENA Annual Technical Status Report, 15 Apr. 1965–15 Apr. 1966
John S. Gordon 15 May 1966 52 p refs
(Contract AF 49(638)-1400)
(TR-64002-F2; AFOSR-66-1366; AD-635161) CFSTI: HC $2.00/MF $0.50

The study was concerned with spectra of premix flames and combustion gases at low pressure, with applications to chemiluminescence, kinetic and reaction mechanism elucidation. Oxidizers were O_2, NO, N_2O, ClO_3F; fuels were CH_4, C_2H_2 and H_2S. Spectral scans coupled with thermochemical analyses indicated several bimolecular reaction mechanisms forming excited species at low pressure with characteristic-signatures: CH+N to CN^*+H; N+O to NO (doublet-PI) to NO^*; CH+CH to C_2^*+H_2; C+HO_2 to CO^*+OH; CH+SH to CS^*+H_2; CCl+OH to CO^*+HCL; C_2+ClO to CCl^*+CO. Several previously unreported CO bands (4th positive system) with V'=0, 1, 2, and 3 were observed. In addition, emission from NH, OH, SO, S_2, CH and CH(+) were seen. Author (TAB)

N66-34823# Royal Norwegian Air Force, Blindern. Inst. of Aviation Medicine.
EFFECT OF VARYING PERCENTAGES AND PARTIAL PRESSURES OF OXYGEN ON FLAME SIZE
F. Nogt Lorentzen Dec. 1965 6 p
(REPT.-65-4; AD-635302) CFSTI: HC $1.00/MF $0.50

The match test (or candle flame) tells whether the O_2 percent is low, before a person experiences any symptoms whatever of hypoxia. The test gives no direct information about CO or CO_2. There may be lethal concentrations of carbon monoxide in the air although the match test is normal. (1% CO caused no change in the flame in some experiments.) In the case of CO_2, such high concentrations are needed to influence the flame that other effects on the individual would be apparent first. In heating appliances where the fuel and air supply are regulated, however, soot and CO formation will occur more easily when the O_2 percentage is low. Even at high altitudes, aircrews should not presume that high percentages of oxygen are less dangerous in case of fire. Author (TAB)

N66-34858*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF THERMODYNAMIC PROPERTIES OF ARBITRARY GAS MIXTURES WITH MODIFIED VIBRATIONAL–ROTATIONAL CORRECTIONS
Dennis O. Allison Washington, NASA, Aug. 1966 45 p refs
(NASA-TN-D-3538) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Equilibrium thermodynamic properties are computed for mixtures of ideal gases including ionization and dissociation. Vibrational–rotational corrections for diatomic species are treated by using a modified method and results are compared with those obtained by a direct-summation method. The modified method takes an order of magnitude less computer time and retains the accuracy of the direct-summation method. Thermodynamic properties are also computed with the rotating harmonic-oscillator model for the diatomic species for comparison purposes. Calculations are made for temperatures up to 15,000°K and pressures up to 100 atmospheres. It is shown that the present diatomic corrections account for most of the difference between the rotating harmonic–oscillator and the virial methodology results for the temperatures and pressures considered. Results are given for three gas mixtures: 100 percent CO_2, a "Mars" atmosphere, and air. Author

N66-34860*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A VISUAL STUDY OF VELOCITY AND BUOYANCY EFFECTS ON BOILING NITROGEN
Robert J. Simoneau and Frederick F. Simon Washington, NASA, Sep. 1966 27 p refs Film Supplement number C-245 to this report is available on loan from Lewis Research Center
(NASA-TN-D-3354) CFSTI: HC $1.00/MF $0.50 CSCL 22M

A visual study of the nucleate and film-boiling regimes of liquid nitrogen was conducted. The test section was a vertical channel heated from one side and operated at low velocity. Nitrogen was caused to flow either upward or downward to evaluate the buoyancy orientation effect on the hydrodynamics of boiling. A strong body-force orientation effect was noted in both boiling regimes at a low velocity of 0.85 foot per second; the effect was reduced at a higher velocity of 3.5 feet per second. The buoyancy effect primarily affects vapor accumulation and bubble trajectory. This, in turn, influences the critical heat flux. An instability of the vapor-liquid interface, analogous to wave formation on a liquid surface by a gas stream, was noted in film boiling. This visual result supports the use of the Helmholtz–Kelvin stability criterion for film boiling. Measurements of the film thickness h_{min} and the most unstable wavelength λ_{us} at the onset of instability indicated that the following relation exists for liquid nitrogen: $\lambda_{us}=4\,h_{min}$. Author

N66-34902# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MEASUREMENT OF TEMPERATURE PROFILES IN BURNING SOLID PROPELLANT
Richard C. Strittmater, H. E. Holmes, and L. A. Watermeier Mar. 1966 24 p refs
(BRL-MR-1737; AD-635188) CFSTI: HC $1.50/MF $0.50

A technique is presented for synchronizing a high speed motion picture record of a small thermocouple emerging from a burning surface with the temperature record from the thermocouple. Experimental results are presented which

show the burning surface temperature of M13 double base propellant to be 535°C at 200 psig. A heat loss analysis is presented which indicates that the thermocouples used in this study, and in fact, all thermocouples used in temperature profile measurement in burning solid propellants have given temperatures much too low. Suggestions are made for measurement technique which would yield more accurate results. Author (TAB)

N66-34937*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF HEAT-REJECTION CHARACTERISTICS OF SPACE RADIATOR PANELS UTILIZING SHARED FINS

Mario A. Colaluca, Henry C. Haller, and Seymour Lieblein Washington, NASA, Aug. 1966 35 p refs

(NASA-TN-D-3598) CFSTI: HC $2.00/MF $0.50 CSCL 13A

An analytical study was performed to provide information on the heat radiated to space from three radiator finned-tube configurations used in a shared-fin radiator. A shared-fin radiator panel contains multiple independent heat-transfer circuits, so that adjacent tubes sharing the fin between them are fed by different circuits. Numerical results for the heat-transfer characteristics of these configurations for the case of loss of heat-transfer fluid in one tube circuit were obtained under condition that all radiating surfaces act as blackbodies. For the case of two independent tube circuits with one circuit inoperative, the heat-rejection rate for the three geometries ranged from 55 to 65% of the value with all circuits functioning properly. For the case of one tube circuit inoperative, the shared-fin arrangement (multiple independent tube circuits) offered an advantage in heat-rejection capability over the simply segmented arrangement (multiple independent panels) that decreased with the design number of circuits. For two independent circuits, the shared-fin heat rejection after puncture was from 10 to 30% greater than for the simply segmented radiator over the range of conditions investigated. For four circuits, the shared fin's advantage was reduced to 3 to 9%. Author

N66-34965# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

INVESTIGATION OF THE MIXING OF PERPENDICULAR GAS JETS AS APPLIED TO SUPERSONIC COMBUSTION

Stephen Patrick Condon (M.S. Thesis) Jun. 1966 83 p refs

(GAM/ME/66B-11; AD-635230) CFSTI: HC $1.50/MF $0.75

An experimental investigation of the turbulent mixing of subsonic, sonic, and supersonic jets of helium discharging transversely into a supersonic jet of air was made using a two-dimensional mixing chamber. The investigation has a potential application in the field of the supersonic combustion ramjet engine. The Mach numbers of the helium jets were 0.75, 1.0, and 1.5, respectively, and the Mach number of the air jet was 1.5. Both the helium and air jets had stagnation temperatures of approximately 76° F. The effects of combustion on the mixing were not considered. Volumetric concentration values and total pressure values were obtained at points in the mixing region, and helium volumetric concentration profiles were plotted. Schlieren photography was used to obtain a visualization of the flow structure. Sonic injection was found to be the most desirable method of injection due to depth of penetration and total pressure considerations. Author (TAB)

N66-34973# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THERMAL ACCOMMODATION COEFFICIENT FOR AIR ON TUNGSTEN

Charles A. Lau (M.S. Thesis) Jun. 1966 76 p refs

(GAM/ME/66B-14; AD-635231) CFSTI: HC $3.00/MF $0.75

The inherently difficult problem of determining thermal accommodation coefficients in air is studied. A solution, to lower the ambient temperature, is tendered. The thermal accommodation coefficient of air on a tungsten wire, 0.005 inches in diameter and 20 inches long, was investigated in the free molecule regime. The coefficient was found to decrease with an increase in temperature: at 140°F and 440°F the values of the coefficient were 0.85 and 0.20 respectively. Author (TAB)

N66-35067# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.

RADIANT HEAT TRANSFER PROBLEMS RELATED TO A CRYOGENIC EMISSIVITY CALORIMETER Technical Report, 1 Jun.–1 Dec. 1965

Emile Rutner Apr. 1966 21 p refs

(AFML-TR-66-35; AD-635225) CFSTI: HC $1.50/MF $0.50

A complete derivation is given for radiant heat transfer between two parallel plates, for the case that the plate separations are not negligible, and emissivities, and absorptivities are a function of temperature. It is assumed that two plates radiating to each other are grey bodies whose emissivities, and absorptivities are a function of temperature. Thus the heat transfer equation has four optical parameters corresponding to the temperatures of the two plates. Author (TAB)

N66-35074# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATION OF THE STATE OF PRODUCTS OF EXPLOSION BY THE METHOD OF MEASUREMENT OF PARAMETERS OF SHOCK

L. N. Pyatnitskiy and O. A. Tsukhanova 17 Jan. 1966 16 p refs Transl. into ENGLISH from Inshenerno-Fiz. Zh. (Minsk), v. 5, no. 5, 1962 p 21–29

(FTD-MT-65-183; AD-635274) CFSTI: HC $1.00/MF $0.50

A method is presented for the investigation of the state of combustion products in a closed pipe; by which the relationship between parameters of combustion products of the mixture CH_4+4O_2 and the coefficient of heat transfer on the one hand and time on the other can be calculated. The law is established of the heat transfer between a gas and the wall of a pipe during nonstationary flow of gas, characteristic for conditions of the experiment, which does not differ greatly from the law described for stationary flow. It is shown that in the conditions of the experiment, where there is a sharp change in the parameters of a gas, the system reaches a state of thermodynamic equilibrium in time of the order of 0.001 seconds. Equilibrium begins to be lost in a time of the order of 0.0001 seconds. Author (TAB)

N66-35105# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.

INTENSITY FLUCTUATIONS OF THE RADIATION FROM A DISPERSIVE BLACK BODY

R. K. Osborn and A. Z. Akcasu Apr. 1966 30 p refs Submitted for Publication

(Contract DA-31-124-ARO(D)-403; ARPA Order 675; Proj. Defender)

(AROD-60925; ORA-07599-5-T; AD-635297) CFSTI: HC $3.00/MF $0.50

Statistical properties of the output fluctuations of a photon detector measuring the intensity of radiation at a given frequency emitted by a dispersive black body are investigated using Langevin's technique. The variance-to-mean ratio of the accumulated counts, and the power spectral density of the count rate are obtained in terms of properties of the emitting medium. The possibility and limitations of obtaining information about the emitter by measuring these quantities are discussed. It is found in particular that the temperature of the emitting medium can be determined in principle by observing

the intensity fluctuations of the radiation at a single frequency. The photon fluctuations in a microwave cavity are also discussed in the framework of the present formulism and compared to previous work. Author (TAB)

N66-35113# Massachusetts Univ., Amherst. Chemical Engineering Dept.

DROPWISE CONDENSATION OF STEAM AT ATMOSPHERIC AND ABOVE ATMOSPHERIC PRESSURES

J. T. O'Bara and E. S. Killian 17 Mar. 1966 27 p refs

(Contract Nonr-3357(02))

(ONR-TR-1; AD-635192) CFSTI: HC $1.00/MF $0.50

In the first phase of this work equivalent heat transfer coefficients at atmospheric pressure for the dropwise condensation of steam were determined experimentally. The coefficients ranged from 1,140 to 37,200 btu/hr sq ft deg F for heat fluxes of 167,000 down to 29,900 BTU/hr ft^2°F with surface temperature differences carrying from 2 to 45°F, vapor velocities varied from 1.75 to 7.52 ft/sec. It was observed that the vapor velocity across the condensing surface has a significant effect on the equivalent transfer coefficient with the coefficient exhibiting a maximum with increasing vapor velocity. It is believed that this maximum reflects the transition between dropwise and mixed condensation resulting from the greater vapor–liquid interfacial shear stress developed at high vapor velocities. Visual observations showed that, as the pressure increases, a transition from dropwise to mixed condensation occurs between 25 and 50 psig. This transition is posited to be associated with the decreased surface tension of the condensed phase at the higher saturation temperatures. Author (TAB)

N66-35209*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECT OF DISCONTINUITIES IN SURFACE CATALYTIC ACTIVITY ON LAMINAR HEAT TRANSFER IN ARC-HEATED NITROGEN STREAMS

Robert E. Sheldahl and Ernest L. Winkler Washington, NASA, Sep. 1966 26 p refs

(NASA-TN-D-3615) CFSTI: HC $1.00/MF $0.50 CSCL 20M

Heat-transfer rates due to forced convection and recombination of dissociated atoms were measured along the afterbodies of hemisphere-cylinders having various discontinuities in surface catalytic activity. Each nose section, which consisted of a hemisphere and a forward portion of the afterbody, was coated with a material of one catalytic activity. The catalytic activity of the material on the remainder of the afterbody surface was either the same or another value. The tests were performed in highly enthalpy streams of partially dissociated nitrogen. The results, compared with a uniformly catalytic test body, show that the use of a noncatalytic material on the forward region of the body substantially increases the heat-transfer rates to the catalytic afterbody surface. This is in qualitative agreement with the theoretical analysis of Chung, Liu, and Mirels. Author

N66-35270# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.

STUDIES OF BURNOUT IN BOILING HEAT TRANSFER TO WATER IN ROUND TUBES WITH NON-UNIFORM HEATING

A. W. Bennett, G. F. Hewitt, H. A. Kearsey, R. K. F. Keeys, and D. J. Pulling May 1966 79 p refs

(AERE-R-5076) CFSTI: HC $3.00/MF $0.75

As an extension of the earlier work on the mechanism of burnout, studies have been made of the effect of a "cold patch" or unheated length placed in various positions along a tube in which burnout heat flux is determined. Experiments of this sort have been done at both low and high pressures and can be interpreted to give information about the behavior of the liquid phase in the channel. This interpretation has been aided by making direct measurements of liquid film flowrate for the low pressure case. It was found that, with the cold patch in certain positions, the power required for burnout could actually be higher than that for a uniform tube of the same total length. The interpretation of the cold patch data suggested that other arrangements of heat flux distribution could give similarly higher powers. Experiments are described on burnout in tubes with a peak in heat flux at the entrance and these results show an improvement in burnout power over wide ranges of conditions. In some tests, burnout did not occur at the end of the heated test section and these results could be interpreted to give the rate of deposition of entrained droplets which in turn led to a calculation of mass transfer coefficient for droplet to wall transfer. Values were also calculated from previous non-uniform and mixed inlet data. Author

N66-35276# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.

THE WETTING OF HOT SURFACES BY WATER IN A STEAM ENVIRONMENT AT HIGH PRESSURE

A. W. Bennett, G. F. Hewitt, H. A. Kearsey, and R. K. F. Keeys May 1966 26 p refs

(AERE-R-5146) CFSTI: HC $1.00/MF $0.50

Measurements are reported of the rate of wetting of the outside of a vertical stainless steel tube by a falling film of water in a steam environment at pressures up to 1000 psia. If the tube temperature exceeds a critical value referred to as the "sputtering" temperature, the rate of wetting decreases with increasing tube temperature. The difference between the sputtering temperature and the saturation temperature was found to pass through a flat maximum with increasing pressure. A value of about 740°F was obtained for the sputtering temperature at 1000 psia. Author

N66-35288# Royal Aircraft Establishment, Farnborough (England).

THERMAL CONTROL SURFACES FOR THE U.K.3 SATELLITE

H. A. J. Prentice and J. Porter Apr. 1966 68 p refs

(RAE-TR-66121) CFSTI: HC $3.00/MF $0.75

The selection and evaluation of thermal control surfaces for the U.K.3 satellite is discussed. The surfaces selected were an electrolytically deposited matte gold surface and black and white polymethylmethacrylate paints. These surfaces were evaluated by exposure to simulated charged particle radiation, simulated solar ultra-violet radiation and thermal cycling under vacuum. This evaluation programme exposed certain areas of weakness in our knowledge of the preparation and application of thermal control surfaces for satellites. Future research work to explore these areas and provide technological information for future satellite projects is discussed. Author

N66-35338# Lockheed Missiles and Space Co., Palo Alto, Calif.

INFLUENCE OF CHEMICAL REACTIONS ON DIFFUSION-CONVECTION ENERGY TRANSFER. 1: LAMINAR-DIFFUSION BOUNDARY LAYER IN THE PRESENCE OF HETEROGENEOUS REACTION ON A CATALYTIC WEDGE SURFACE

V. I. Makariavichius and M. M. Tamonis [1965] 15 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai, Ser. B, (Vilna), v. 4, no. 43, 1965 p 153–163

An integral method, using a cubic concentration profile in the boundary layer, is presented as a solution to the diffusion equation of a chemically reacting substance in the presence of a heterogeneous reaction on an isothermal surface. The solution is depicted graphically as a function of the nondimensional parameter, the order of the reaction, and the Euler number. It is pointed out that if the chemical reaction rate

depends on the concentration of several components, then the mass transfer rate depends on the magnitudes of the initial concentrations and the diffusion coefficients of the reacting components. The hydrodynamic conditions of diffusion–conventive energy transfer are taken into account by the Euler number. The resultant heat flux for a complex diffusion–convective energy transfer may be generalized by the customary criterial equations if a chemical energy transfer potential is introduced for computing the heat emission coefficient. Although the method is not highly accurate, the avoidance of complex computations and its use for graphic representation of the processes are cited as advantages. M.G.J.

N66-35342# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF DETERMINING THE HEAT EXCHANGE IN LAMINAR VARIABLE-VISCOSITY FLUID FLOW IN A PLANE CHANNEL (1. AT CONSTANT WALL TEMPERATURE)
N. S. Liutikas and A. A. Zhukauskas [1965] 16 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai: Ser. B (Vilna), v. 4, no. 43, 1965 p 139–152

An approximate analytical solution of heat exchange is presented for the case of stationary, axisymmetric, laminar motion of an incompressible fluid with variable viscosity under conditions of constant wall temperature. The fundamental equations and assumptions are given. A refined integral method is used for both the initial thermal portion, and for the thermally stabilized portion of the flow. A fourth power polynomial is used for the temperature distribution. Results of a computation for a certain type oil are compared with theoretical computations and experimental data; good agreement was obtained. M.G.J.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-34210# RAND Corp., Santa Monica, Calif.
ECONOMIC IMPACT OF SPACE EXPENDITURES
S. M. Barro Jun. 1966 16 p
(P-3386; AD-634353) CFSTI: HC $1.00/MF $0.50

The discussion deals with the fiscal effects of space spending. At least three different categories of potential benefits are examined: (1) Direct economic outputs from space operations. The primary examples to date have been communication, weather, and navigation satellites. There have not been any equivalent applications of manned space vehicles. (2) Technological spillover. This term has been used to refer to fairly direct transfers to civilian technology of products, materials, and processes developed for the space program. The aggregate economic significance of spillovers thus far identified has not been very impressive. (3) General contributions to science and technology. This category comprises all of the economic benefits that might, in principle, be traced to the space program's augmentation of the nation's total R and D effort. It provides the broadest possibilities for claims about economic benefits from space, but of course, the most limited possibilities for rigorous measurement and verification. TAB

N66-34308# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 2, NO. 7
Jul. 1966 98 p refs

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1. APPARATUS AND TECHNIQUES FOR PLASMA DIAGNOSTICS S. G. Hibben p 1–18 refs (See N66-34307 20-25)

2. DEVELOPMENT OF POLYARYL ESTERS IN THE USSR B. Ofrossimow p 19–33 refs (See N66-34308 20-06)

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5. SOME REMARKS OF PRESIDENT M. V. KELDYSH IN HIS OPENING ADDRESS AT THE ANNUAL MEETING OF THE ACADEMY OF SCIENCES USSR p 58–59

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16. PHYSICAL METALLURGY AND METAL PHYSICS OF SUPERCONDUCTORS p 89–90

N66-34366*# National Aeronautics and Space Administration, Washington, D.C.
INDEX TO NASA TECH BRIEFS, JANUARY–JUNE 1966
Aug. 1966 62 p refs
(NASA-SP-5021(03)) CFSTI: HC $1.00/MF $0.75 CSCL 05B

An annotated bibliography is presented of NASA Tech Briefs, along with subject and number indexes. Annotations are given under the following categories: (1) *Electrical (Electronic)*, (2) *Physical Sciences (Energy Sources)*, (3) *Materials (Chemistry)*, (4) *Life Sciences*, and (5) *Mechanical*. M.W.R.

N66-34586# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 2, NO. 8
Aug. 1966 57 p refs

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1. OPTIMIZATION OF THE TRAJECTORY OF MULTI-STAGE FLIGHT VEHICLES L. Kacinskas p 1–3 ref (See N66-34587 20-30)

2. A METHOD INCREASING DIGITAL DATA TRANSMISSION SPEED B. Doncov p 4–6 refs (See N66-34588 20-07)

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7. EXPERIMENTAL INVESTIGATION OF ATMOSPHERIC TRANSMITTANCE AT WAVELENGTHS IN THE SUBMILLIMETER RANGE p 31-33 refs (See N66-34573 20-13)

8. LEAD METANIOBATE PIEZOELECTRIC VIBRATION PICKUP p 33-35 ref (See N66-34574 20-09)

9. CONFERENCE ON RESEARCH REACTORS p 36-38

10. FIFTH SCIENTIFIC CONFERENCE ON THE PROBLEMS OF EVAPORATION, COMBUSTION, AND GAS DYNAMICS OF DISPERSED SYSTEMS (USSR) p 38-40

11. THE SECOND ALL-UNION CONFERENCE ON AVIATION AND SPACE MEDICINE p 40-42

12. ALL-UNION SEMINAR ON THE INTERACTION OF HIGH-TEMPERATURE MATERIALS WITH AMBIENT MEDIA p 42-46

13. NUMERICAL REALIZATION OF VARIATIONAL METHODS S. G. Mikhlin p 47-49

N66-35013*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

RESEARCH AND ADVANCED DEVELOPMENT PUBLICATIONS OF THE JET PROPULSION LABORATORY, FISCAL YEAR 1965

1 Jul. 1966 25 p

(NASA-CR-77377) CFSTI: HC $1.00/MF $0.50 CSCL 05 B

A total of 864 publications were quantitatively analyzed and are presented in tabular form by category, by NASA funding offices, and by subprograms in these offices. A list of the publications in the open literature during FY-65 is appended, including such topics as gas kinetics, dyadic analysis of space-time congruences, photoelectric spectrophotometry of selected southern stars, rocket measurement of the photoelectron-excited ultraviolet dayglow, and polymeric semiconductors. L.E.W.

N66-35165# Congress. House. Committee on Science and Astronautics. Subcommittee on NASA Oversight.

FUTURE NATIONAL SPACE OBJECTIVES

James E. Wilson and Joseph M. Felton Washington, GPO, 1966 488 p Staff Study for the Subcomm. on NASA Oversight, 89th Congr., 2d Sess.

This study, prepared for the Subcommittee on NASA Oversight of the House Committee on Science and Astronautics, represents a compilation of varying viewpoints on the possible future objectives for the national space effort. R.N.A.

N66-35221*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AERO-ASTRODYNAMICS RESEARCH REVIEW NO. 4, JULY 1-DECEMBER 31, 1965

William D. Murphree, ed. 1 Apr. 1966 130 p refs

(NASA-TM-X-53462) CFSTI: HC $3.00/MF $1.00 CSCL 22A

A review of research in the following areas is reported: Aerothermodynamics, Fluid Mechanics, Instrumentation, Orbit Theory and Prediction, Selenography, Space Environment, and Structural Dynamics. Cited are papers on: convective heat transfer in turbulent, supersonic base flow; fluid mechanics regimes related to propellant oscillations under low gravity conditions; remote sensing with optical cross correlation methods; the application of the Q-ball angle of attack transducer to large space vehicles; a solution to a problem of orbit determination with possible applicability to the abort guidance problem; a lunar maria terrain model for use in lunar surface vehicle; revised meteoroid flux and puncture models; radiation pressure and its effects on satellite motion; the dynamic approach of fuel sloshing problems in a space vehicle; and wind penetration effects on flight simulations. S.C.W.

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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TECHNICAL TRANSLATIONS: Information published in a foreign language considered to merit NASA distribution in English.

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